PAKISTAN: INSIGHTS INTO ITS GEOGRAPHY AND ECONOMY

BY:
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FOR O LEVELS/IGCSE
PAKISTAN STUDIES
PAPER 2



PICTURE BY GUILHEM VILLET



PREFACE

I am eternally grateful to God Almighty, Who Has guided me throughout this difficult journey. It was a journey which seemed impossible to accomplish from the very start till the very end. I am deeply humbled towards my parents, my brother and the school administration for developing a keen interest in my efforts and for providing the moral support I needed to complete this textbook. I am thankful to all my teachers, who have instilled in me the values of patience, courage and discipline. I am also indebted to **Sir Jalil** (whose notes have come to good aid of me) and **Sir Usman** (who encouraged me to pursue this project). I would also sincerely thank my friends (Maaz, Daniyal and Faseeh) for their valuable contribution to this book. I hope that you will find this textbook as a helpful guide; one that is both precise and one which fosters an appreciation for the relevance of this subject in everyday life. I sincerely believe that this is a compilation for the less fortunate, a compilation; that will hopefully prove affordable for all of those who wish to quench their thirst for knowledge but do not have the means to do so. Education is every child's right, and I would like to share what I have learnt with others around me, so that they may facilitate the less fortunate of tomorrow. I hope that this ambition and enthusiasm lives on in all those who may benefit from this textbook.

May God Bless you all

PICTURE BY
AHMED ZAIGHAM

PAKISTAN

AUGUST 11, 1947

"Dealing with our first function in this Assembly, I cannot make any well-considered pronouncement at this moment, but I shall say a few things as they occur to me. The first and the foremost thing that I would like to emphasize is this: remember that you are now a sovereign legislative body and you have got all the powers. It, therefore, places on you the gravest responsibility as to how you should take your decisions. The first observation that I would like to make is this: You will no doubt agree with me that the first duty of a government is to maintain law and order, so that the life, property and religious beliefs of its subjects are fully protected by the State.

The second thing that occurs to me is this: One of the biggest curses from which India is suffering - I do not say that other countries are free from it, but, I think our condition is much worse - is bribery and corruption. That really is a poison. We must put that down with an iron hand and I hope that you will take adequate measures as soon as it is possible for this Assembly to do so.

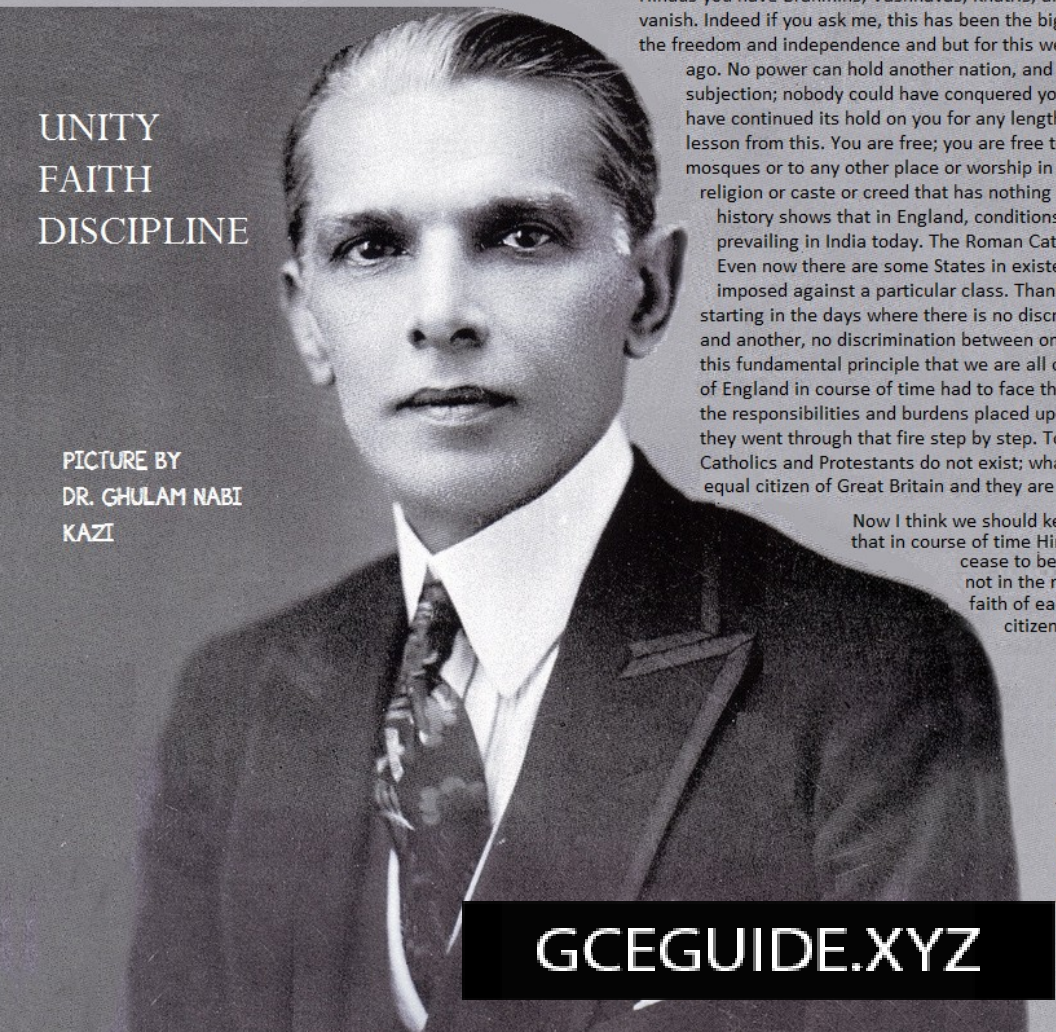
Black-marketing is another curse. Well, I know that blackmarketeers are frequently caught and punished. Judicial sentences are passed or sometimes fines only are imposed. Now you have to tackle this monster, which today is a colossal crime against society, in our distressed conditions, when we constantly face shortage of food and other essential commodities of life. A citizen who does black-marketing commits, I think, a greater crime than the biggest and most grievous of crimes. These blackmarketeers are really knowing, intelligent and ordinarily responsible people, and when they indulge in black-marketing, I think they ought to be very severely punished, because the entire system of control and regulation of foodstuffs and essential commodities, and cause wholesale starvation and want and even death.

The next thing that strikes me is this: Here again it is a legacy which has been passed on to us. Along with many other things, good and bad, has arrived this great evil, the evil of nepotism and jobbery. I want to make it quite clear that I shall never tolerate any kind of jobbery, nepotism or any any influence directly of indirectly brought to bear upon me. Whenever I will find that such a practice is in vogue or is continuing anywhere, low or high, I shall certainly not countenance it.

I know there are people who do not quite agree with the division of India and the partition of the Punjab and Bengal. Much has been said against it, but now that it has been accepted, it is the duty of everyone of us to loyally abide by it and honourably act according to the agreement which is now final and binding on all. But you must remember, as I have said, that this mighty revolution that has taken place is unprecedented. One can quite understand the feeling that exists between the two communities wherever one community is in majority and the other is in minority. But the question is, whether it was possible or practicable to act otherwise than what has been done, A division had to take place. On both sides, in Hindustan and Pakistan, there are sections of people who may not agree with it, who may not like it, but in my judgement there was no other solution and I am sure future history will record is verdict in favour of it. And what is more, it will be proved by actual experience as we go on that was the only solution of India's constitutional problem. Any idea of a united India could never have worked and in my judgement it would have led us to terrific disaster. Maybe that view is correct; maybe it is not; that remains to be seen. All the same, in this division it was impossible to avoid the question of minorities being in one Dominion or the other. Now that was unavoidable. There is no other solution. Now what shall we do? Now, if we want to make this great State of Pakistan happy and prosperous, we should wholly and solely concentrate on the well-being of the people, and especially of the masses and the poor. If you will work in co-operation, forgetting the past, burying the hatchet, you are bound to succeed. If you change your past and work together in a spirit that everyone of you, no matter to what community he belongs, no matter what relations he had with you in the past, no matter what is his colour, caste or creed, is first, second and last a citizen of this State with equal rights, privileges, and obligations, there will be no end to the progress you will make.

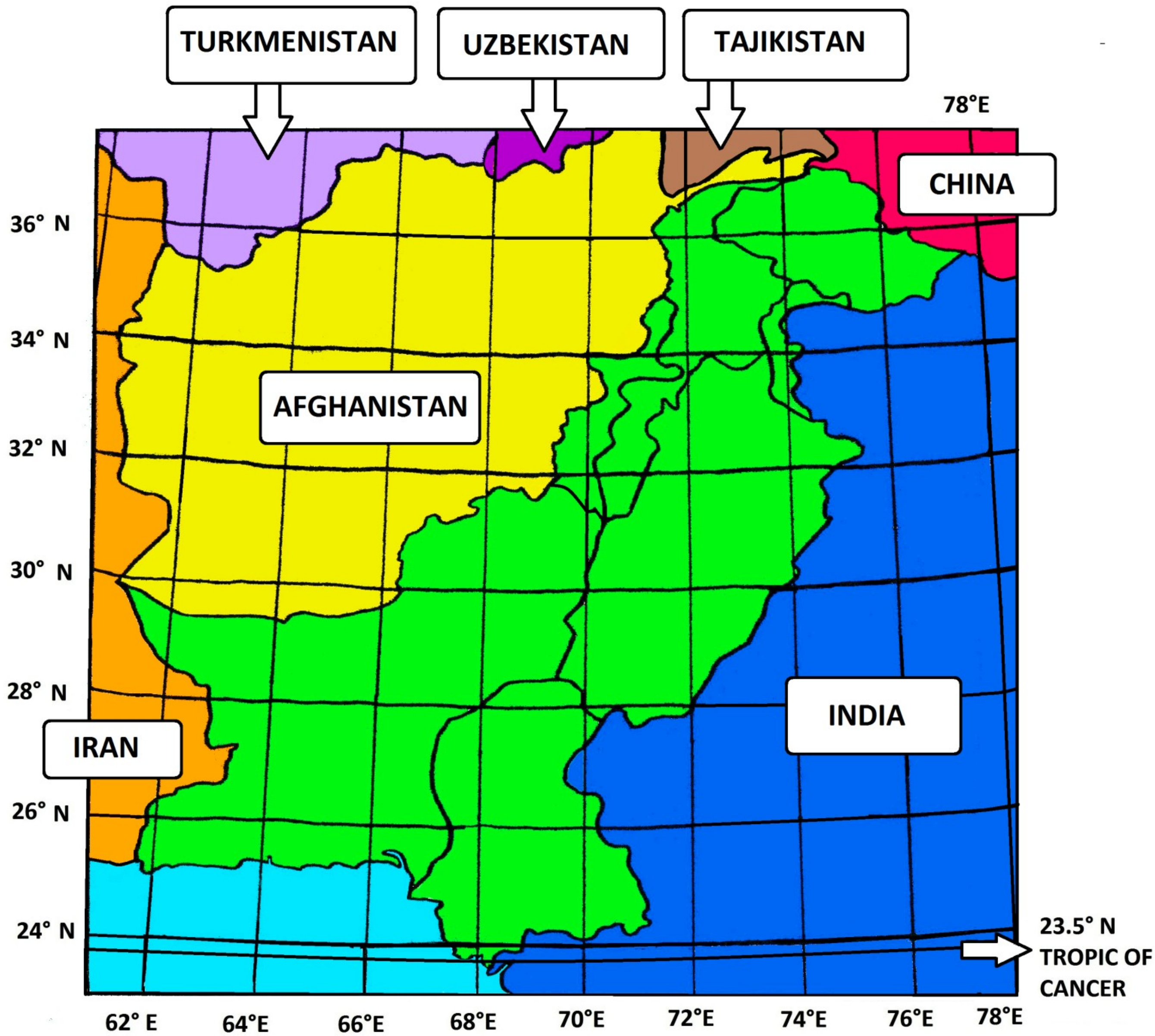
I cannot emphasize it too much. We should begin to work in that spirit and in course of time all these angularities of the majority and minority communities, the Hindu community and the Muslim community, because even as regards Muslims you have Pathans, Punjabis, Shias, Sunnis and so on, and among the Hindus you have Brahmins, Vashnavas, Khatris, also Bengalis, Madrasis and so on, will vanish. Indeed if you ask me, this has been the biggest hindrance in the way of India to attain the freedom and independence and but for this we would have been free people long long ago. No power can hold another nation, and specially a nation of 400 million souls in subjection; nobody could have conquered you, and even if it had happened, nobody could have continued its hold on you for any length of time, but for this. Therefore, we must learn a lesson from this. You are free; you are free to go to your temples, you are free to go to your mosques or to any other place or worship in this State of Pakistan. You may belong to any religion or caste or creed that has nothing to do with the business of the State. As you know, history shows that in England, conditions, some time ago, were much worse than those prevailing in India today. The Roman Catholics and the Protestants persecuted each other. Even now there are some States in existence where there are discriminations made and bars imposed against a particular class. Thank God, we are not starting in those days. We are starting in the days where there is no discrimination, no distinction between one community and another, no discrimination between one caste or creed and another. We are starting with this fundamental principle that we are all citizens and equal citizens of one State. The people of England in course of time had to face the realities of the situation and had to discharge the responsibilities and burdens placed upon them by the government of their country and they went through that fire step by step. Today, you might say with justice that Roman Catholics and Protestants do not exist; what exists now is that every man is a citizen, an equal citizen of Great Britain and they are all members of the Nation.

Now I think we should keep that in front of us as our ideal and you will find that in course of time Hindus would cease to be Hindus and Muslims would cease to be Hindus and Muslims would cease to be Muslims, not in the religious sense, because that is the personal faith of each individual, but in the political sense as citizens of the State."



MR. JINNAH'S PRESIDENTIAL ADDRESS TO THE CONSTITUENT ASSEMBLY OF PAKISTAN

INTRODUCTION TO PAKISTAN



Pakistan is located at the epicenter of three important regions of Asia: Central Asia to the north, the Indian Subcontinent to the east and the Middle East to the west. Pakistan is located in South Asia and covers an area of around 796,000 km^2 That is equal to the area of Britain and France combined. It has an approximate 1,046 km long coastline along the Arabian Sea

The geography of Pakistan is a mixture of landscapes varying from plains to mountains, deserts to forests, and plateaus to the coastal areas

Pakistan's climate varies from tropical to temperate. Rainfall varies from year to year, and unusual patterns of flooding and drought are common

Pakistan's native flora reflects its varied climatic zones; from Conifers in the north to Mangroves in south, and from desert bushes in the east to Junipers in the west. Pakistan’s native fauna consists of the exotic snow leopard in north to cheetahs in the remote west. Pakistan is also home to many species of birds and mammals including the rare River Indus Dolphin

Pakistan has a semi-industrialized economy with the main foci located along the Indus River. Diversified economies of Karachi and Punjab's urban centers coexist with lesser developed areas in other parts of the country. The economy has suffered in the past from decades of internal political disputes, a fast growing population, mixed levels of foreign investment, and a costly confrontation with militants and neighboring India. In recent years, wide-ranging economic reforms have resulted in a stronger economic growth in both the manufacturing sector (such as apparel, textiles, cement etc) and financial service sectors (telecommunications, transportation, advertising, and finance). Furthermore there has been a gradual improvement in the foreign exchange and hard currency reserves

The estimated population of Pakistan in 2011 is around 178 million making it the world's sixth most-populous country, behind Brazil and ahead of Bangladesh. Pakistan has the world’s ninth largest labour force of 55 million alongside a 35 million strong middle class but shamefully Pakistan has only 3 million taxpayers

PICTURE BY FAISAL SAEED


GILGIT-BALTISTAN
CHITRAL
GILGIT
KHYBER PAKTUNKHWA
PESHAWAR
AZAD KASHMIR
ISLAMABAD/
RAWALPINDI
FATA
SIALKOT
GUJRANWALA
LAHORE
FAISALABAD
QUETTA
MULTAN
PUNJAB
BALOCHISTAN
SINDH
HYDERABAD
GWADAR
KARACHI

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TOPOGRAPHY OF PAKISTAN

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*Effects of topography on human activities

ACKNOWLEDGEMENTS

Fig 1.3	Faisal Saeed
Fig 1.4	Arshad Ali
Fig 1.5	Arshad Ali
Fig 1.7	Ahsan Ali
Fig 1.9	Danniel Collins
Fig 1.10	NASA
Fig 1.12	Bilal Soomro
Fig 1.13	NASA
Fig 1.17	Muhammad Furqan

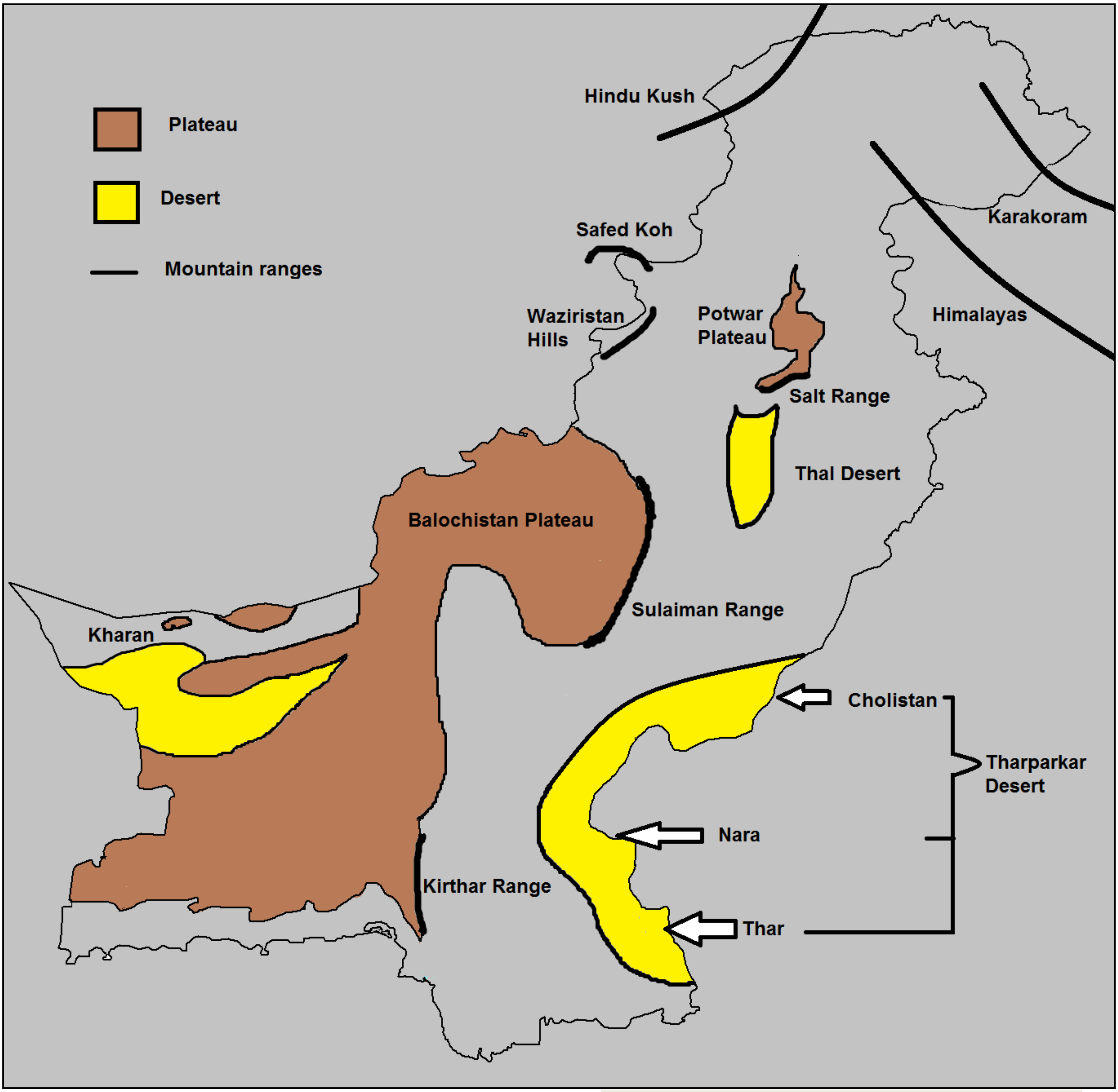


Fig 1.1

Definitions

Topography is the detailed study of the surface features of a region.

A **Hill** is generally considered to be an elevated piece of land less than 600 -610 meters high, and a **Mountain** is an elevation of land that is more than 610m high. But it must be remembered that there is no universally acceptable definition. Some hills are called mountains while some mountains are referred to as hills.

A **Mountain Range** is a succession of mountains which have the same direction, age and same causes of formation etc

A **snowfield** is a **huge permanent** expanse of snow

Northern Mountains

The Northern Mountains are divided into three main mountain ranges; the Karakoram, Himalayas and the Hindu Kush. These three have a dominating physical presence in the northern areas of Pakistan

Topography

The **Karakoram** runs from *South East to* North-West. They have an average height of 6000*m*. The **Himalayas** run from South-East to North-West and have an average height of 4000*m*. The **Hindu Kush** runs from North East to South West with an average height of 5000*m*.

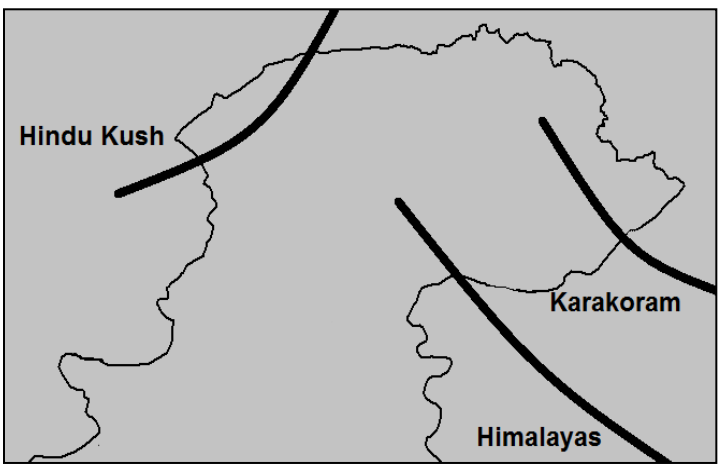


Fig1.2

Physical features are:

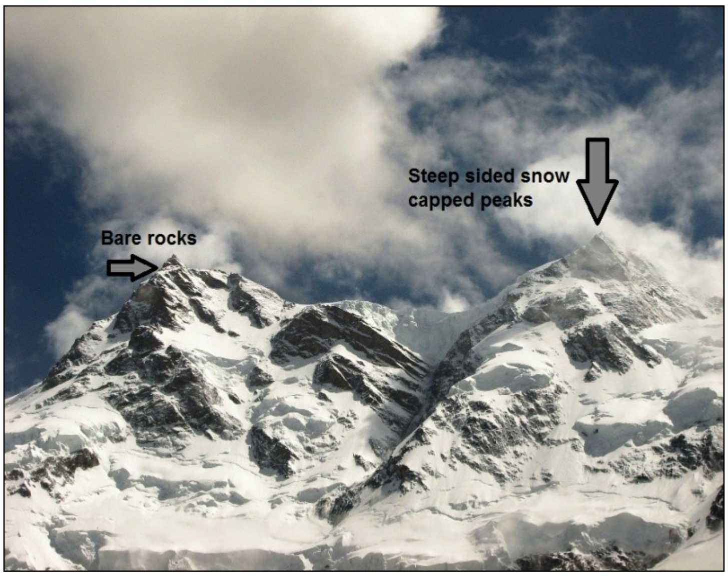
These mountain ranges have deep narrow valleys such as Gilgit and Chitral.

- Mountains are snow capped (like K2) and have steep sided slopes
- The peaks are conically shaped; like Rakaposhi 7788m.
- The height of mountains in a mountain range **generally** shows a trend; their height increases as we move from South towards the North.
- These ranges have fast flowing rivers like the River Gilgit, which has formed alluvial fans and deep narrow gorges
- These mountain ranges are also referred to as the 3rd pole of the Earth because of the large concentration of massive glaciers like Baltoro and Siachen. These glaciers have carved out different features like glacial moraines. (A **Moraine** is an accumulation of a loose mixture of soil and round rocks, which were deposited by retreating glaciers at the end of the last Ice Age.)



Fig1.3

Fig 1.4



- The soil cover on slopes is extremely thin; the mountains have bare rocks, which support little plant growth as plants need soil (so their roots could absorb both minerals and water for growth).
- These rocks usually undergo the process of weathering (by wind, water and lichens etc), which gradually break down the rock into small soil particles over a long time



Fig 1.5

Drainage

The Southern slopes of the **Himalayas** are drained by Eastern tributaries of the River Indus; Jhelum, Chenab, Ravi, Sutlej and Beas. All of these Rivers run in North-East to South West direction

The Southern and Northern slopes of **Karakoram** are drained by River Indus and some of its Western tributaries like River Gilgit respectively. Both of these rivers run in an East to West direction

The **Hindu Kush** is drained by the River Indus and some of its Western tributaries like Mastuj, which has formed alluvial fans and deep narrow gorges.

Snowfields are found in areas which are 4000m +. These areas experience very low temperatures thus more ice is replenished

during the wet season as compared to the amount that is lost due to melting. Thus snowfields are permanent expanses of snow (snow is present all year round)

Western Mountains

This region consists of the mountain ranges, namely; the Waziristan hills, the Safed Koh range, the Sulaiman range and the Kirthar range (shown on next page)

Topography

- All of these ranges run in the North-South direction except the Safed Koh, which runs from East to West.
- **The Safed Koh** mountain range is the only range, which has some existing snow capped peaks. Other ranges are quite dry.
- These mountains **generally** have bare rocks due to low rainfall and in some cases very high temperatures (which leads to high rate of evaporation).
- These mountain ranges have steep sided peaks along with deep narrow valleys and gorges

Drainage

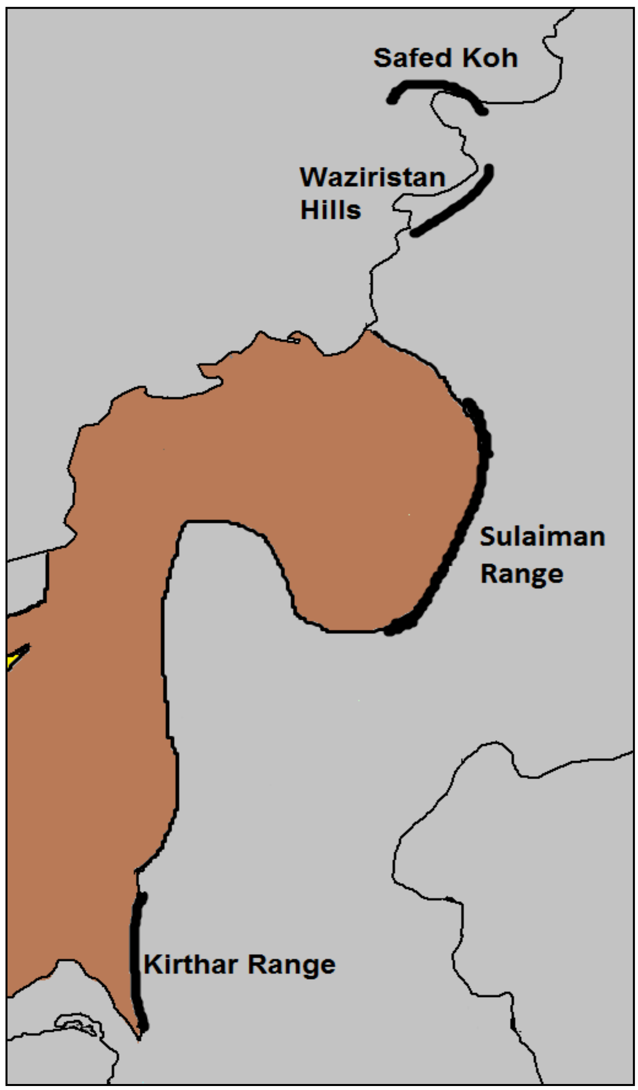
The Safed Koh range is drained by River Kabul, which runs in an West to East direction and eventually joins River Indus

The Waziristan hills are drained by small seasonal rivers like Kurram, Tochi and Gomal. These rivers run from West to East, and **all** are the Western tributaries of the River Indus

The Sulaiman range is drained by small hill torrents and small seasonal rivers such as the Bolan and Mula. These rivers **usually** lead to small inland lakes, where the water collects and then dries up (for example the lake Damas)

T he rain falling on Eastern slopes of Sulaiman range runs down the slopes and falls into piedmont plains leading to the formation of alluvial fans

Fig 1.6



The Kirthar range on the other hand is drained by the River Hab (seasonal river), which flows in a North to South direction and eventually joins the Arabian Sea

Balochistan Plateau

Topography

Plateau is an area of highland, which is **usually** flat although a heavily dissected plateau can also exist

Features are:

- Balochistan Plateau has a height varying from around 600m to around 3000m
- It has deep narrow valleys like Quetta
- They have bare rocks due to lack of rainfall
- The mountains have steep slopes and none are snow capped.



Fig 1.7

- There are parallel ranges running in an East to West direction for example the Chagai Hills, Raskoh Range, and Makran Coastal Range are all parallel ranges
- Parallel ranges running North-South direction are Central Brahui and the Hala range

Drainage

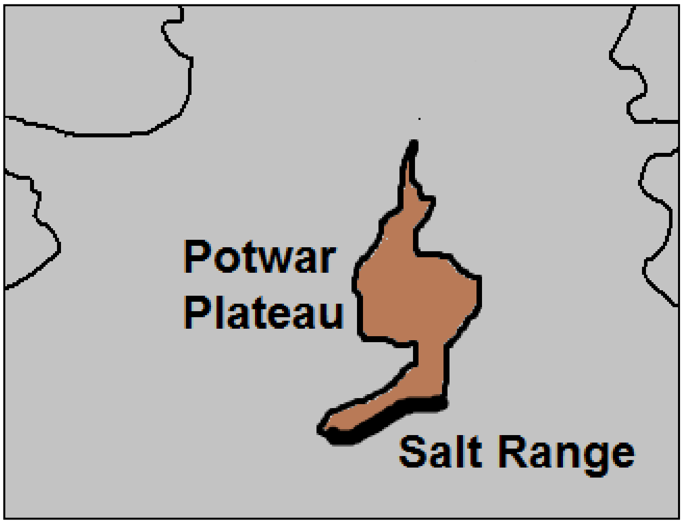
In the Southern part of the Balochistan Plateau, the River Dasht and River Porali flow from north to South, thus eventually draining into the Arabian Sea. Both are seasonal rivers; they flow **only** during the rainy season.

In Central Balochistan, water either drains into inland lakes known as Hamuns or is absorbed into the ground, if not, it evaporates. Dry lakes known as **Hamun** exist (like Hamun-i-Mashkel). They are formed when seasonal rivers flow into them during the rainy season. A Hamun is a sort of depression on the Earth's surface.

In Northern Balochistan, River Zhob flows from southwest towards northeast. It eventually meets the River Gomal, which is a western tributary of the River Indus.

Potwar Plateau

Fig 1.8



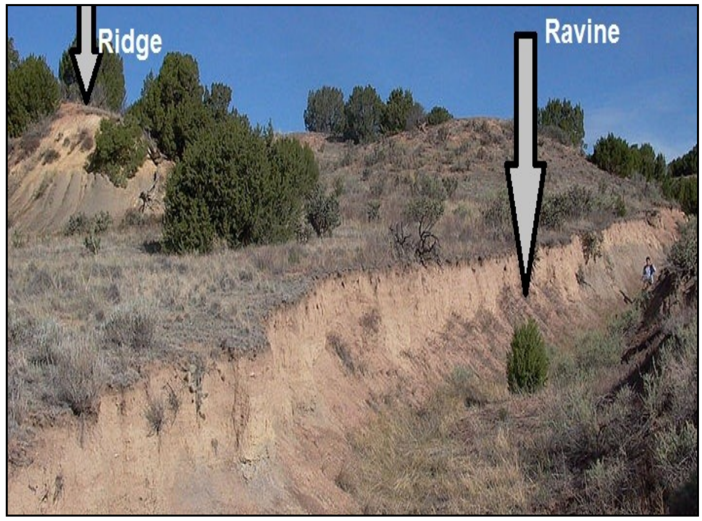
This plateau covers the northern parts of Punjab and some of the western part of Azad Kashmir. To the North of the plateau we find the Margalla Hills, in the South the Salt range, in the East River Jhelum and on the West the River Indus.

Topography

Features are:

- Height ranges from 305 to 610m and represents a region of badland topography.
- The hills have steep slopes and are badly dissected, faulted and folded.
- Many residual hills are present, a feature left by the last Ice Age due to retreating glaciers.
- Ravines (shallow, steep sided narrow valleys) are present between ridges (elevated pieces of land that run for some distance). Ravines are formed due to the erosion of soft rock by flowing water over a long period of time

Fig 1.9



- Furrows (shallow long running ditches) are formed by the flow of rainwater. Overtime the land becomes deeply dissected as the substantial flow rainwater (during heavy downpour) enlarges the furrows into gullies (deep long running ditches)

Drainage

River Soan drains much of Potwar Plateau. It runs from North-East to South-West and eventually drains into the River Indus. Other small rivers are also present but **all** are active in the rainy season. These rivers have meanders (curves in the path of a river) because they have to flow around small hills

Alluvial plains have also formed along the rivers due to seasonal flooding and the consequent deposition of silt by the river

Salt Range

The Salt range is bordered by Potwar Plateau in the North, River Indus on the west and River Jhelum on the east

Topography

It consists of parallel mountains, which **generally** run from North-East to South-West. The height of the range varies from 750-900m

The mountain range slopes gently towards the Potwar Plateau (in the north) but slopes steeply towards the Upper Indus Plain (in the south)

Drainage

- On the Northern side of the Salt range, several saline lakes are found (such as Kallar Kahar and Khabeki). The water in these lakes does **NOT** drain into any of the rivers of the Potwar Plateau.

- The southern side of the Salt Range is drained by several small rivers like Khewra, which are only active during rainy season. They soak into the piedmont plains after splitting up into small streams and channels

The split occurs due to the sudden change of gradient (as river flows from hill to the foothill), which means that the carrying capacity of the river is reduced. The river drops part of its load within the streams, which themselves split into a number of narrower channels. These channels do not have the speed to carry the entire sediment load; thus, they dry up before they could reach the Indus River. Figure 6 shows an alluvial fan in Iran, where the foothills are utilized for growing crops (so they are green and yellow)



Fig 1.10 NASA

Indus Plain

The Indus Plain is divided into two regions; the Upper Indus Plain and the Lower Indus Plain.

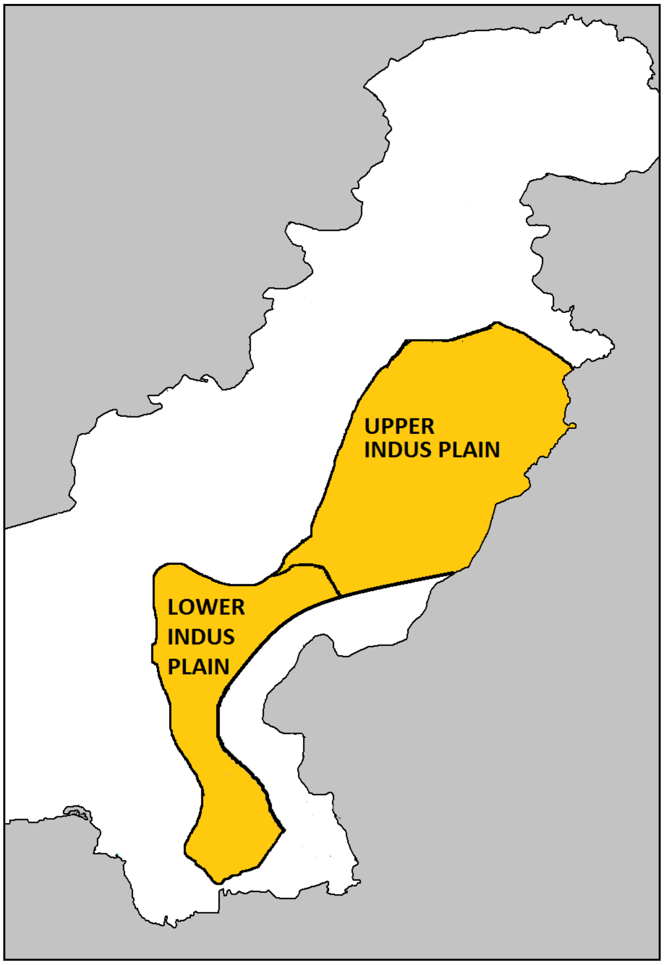


Fig 1.11

The Upper Indus Plain extends from areas below Kashmir and Lesser Himalayas to Mithankot.

The Lower Indus Plain extends from Mithankot to the Indus Delta.

Topography

Both of the Indus Plains are flat pieces of **usually** fertile land

Features:

- **Upper Indus Plain**

In the upper Indus plain there are **doabs** (a doab is a land between two rivers) e.g. Bari Doab. Bars (alluvial terraces) are also present, which are 7-12m high e.g. the Nilli and Ganji Bars.(See next to next page for diagram)

The rivers keep on changing their course slightly (meanders)**.** There are levees along the river bed, which help contain the river.

Active flood plains are present alongside the river; these are low lying areas of flat land, which are annually flooded in the rainy season. The active flood plain is made up of new alluvium

The old flood plains are also present. They are flat areas, which are higher than active flood plains. They are made up of old alluvium, which had been deposited a decade ago. They're flooded after a decade or so, when **strong monsoon winds** combine with the **heavy** melting of snow and ice in the glaciers of the Northern Mountains.

Piedmont plains are found at the foothills of the Himalayas in the Salt Range. They are formed by the deposition of material by hill torrents, when they lose their speed. Kirak Hills exist between the River Chenab and Jhelum

- **Lower Indus Plain**

The Lower Indus Plain principally differs from the Upper Indus Plain due to presence of a tidal delta (the Indus Delta) and also because in the Lower Indus Plain only one river that is, the river Indus, flows.

Indus delta exists in **some** of the southern parts of the Lower Indus Plain. A delta is a low lying triangular area which has alluvial deposits. Here the river divides into ***distributaries*** before entering a larger body of water (in this case the Arabian Sea). The delta exists because of the deposition of material carried by the river. This happens because when the river enters into the sea, it loses its speed and thus also loses its ability to hold this material, which is therefore deposited at the mouth of the river.

In the lower Indus Plain, we may find limestone ridges which are known as **cuestas,** a few examples being; Rohri and Gango Takar Cusetas.

Fig 1.12 **Rohri Cuesta**



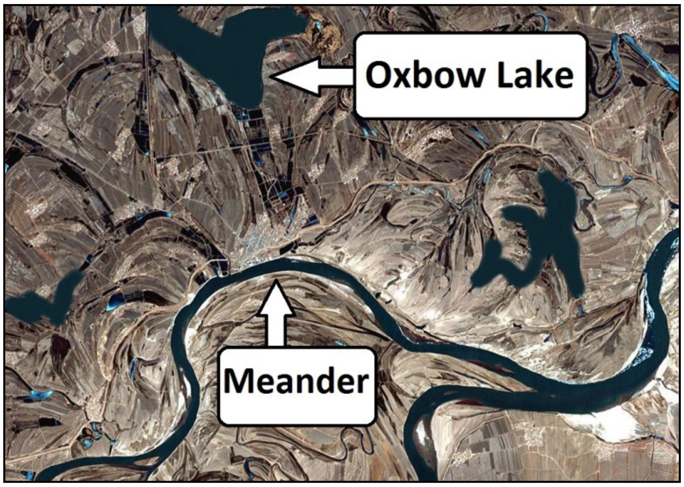


Fig 1.13

Oxbow lakes are also present in the lower Indus plain. Active and Old Flood Plains are also present, but a doab and alluvial terraces are absent. Meanders however are present too.

Piedmont Plains are present at the foothills of Kirthar and Sulaiman Mountain ranges. Part of the Indus plain that extends into Balochistan is known as the Kachi Sibi Plain.

Both these plains have rolling sand dunes (Thal and Thar deserts), flat plain areas, have some low lying hills, oxbow lakes and meanders etc.

The main differences are the number of tributaries and distributaries (delta) in both the plains, how much water each of the plain contributes to the Indus River system (The Upper Indus Plain contributes more towards the volume of water in the form of rain etc). The Upper Indus Plain is also a bit higher than the low lying Lower Indus Plain. Considering the altitude of these two plains, we see that it decreases from North towards the South **generally**.

Drainage of Indus Plain

The Lower Indus plain is drained by the River Indus mainly flowing in the North-South direction. Meanders and oxbow lakes also exist. Piedmont plains exist in-between the river Indus and Sulaiman and Kirthar Mountain ranges.

In the Upper Indus plain, River Indus and its Eastern tributaries flow in North- South direction. Tributaries are Jhelum, Chenab, Ravi and Sutlej. Meanders and oxbow lakes also exist.

Features of a Doab

There are 4 doabs found in Upper Indus Plain **ONLY**. Their main features are:

- ### Active Flood Plain

It is a flat plain on both sides of a river, which suffers annual floods during the rainy season. It is around 2-3m above the level of a river. It is around 10-20km long. The river always changes its position, thus meanders have come into existence. Abandoned (dry) and braided channels are also visible in the dry season. Meanders, oxbow lakes and embankments of a river can be seen as well.

Soils of loam and silt (Alluvial Soils), which are good for farming, are present in both the UIP and LIP.

- ### Old flood Plain

It is higher than active flood plain around 5m higher than river level. It is around 10-20m long. It is made up of old alluvium. Evidence of meanders and of levees is present in these plains. Oxbow lake depressions can also be seen. The old flood plains are present in both UIP and LIP.

- ### Bars (Alluvial Terraces)

These are flat areas which are **only** found in the Upper Indus plain. They are 7—12m high and last for 25-35km. They are made up of areas of silt and clay. In Pakistan all the bars have a south west direction.

- ### Scarp

Scarp is a slope,, which separates the old flood plain from the bar upland. It is around 20m long and 11m high above the river level. It is made when old alluvium on the bar upland is eroded, thus, leaving a slope which connects both old flood plain and the bar upland

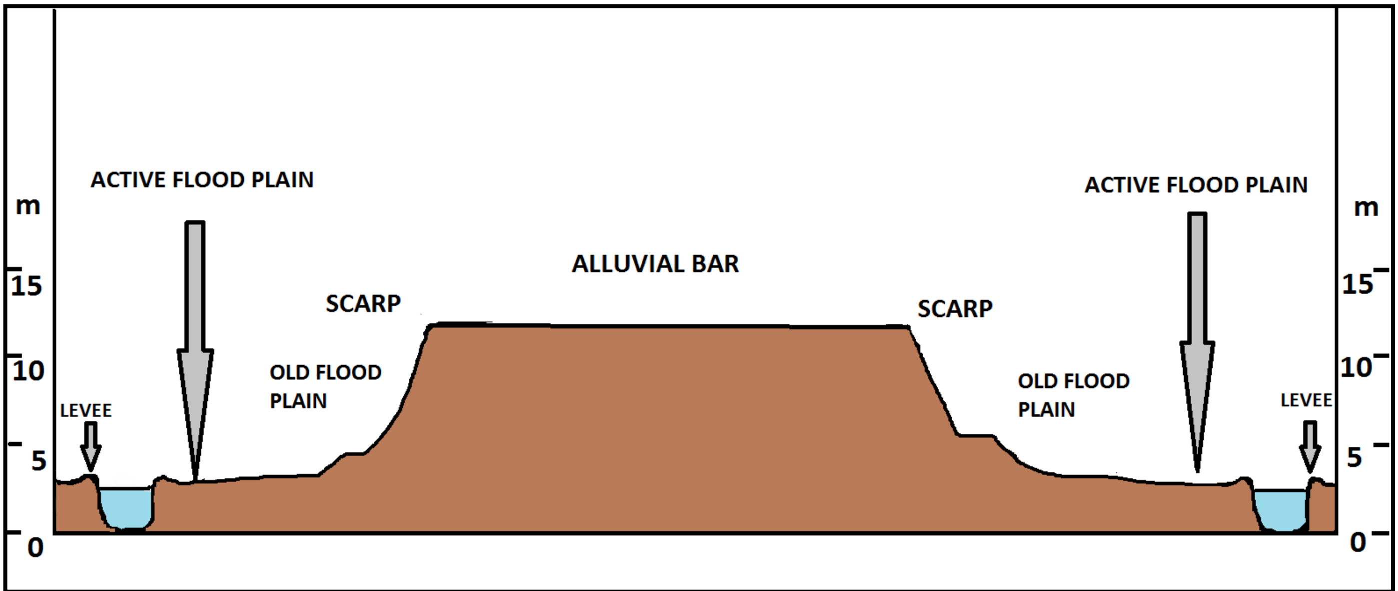


Fig 1.14

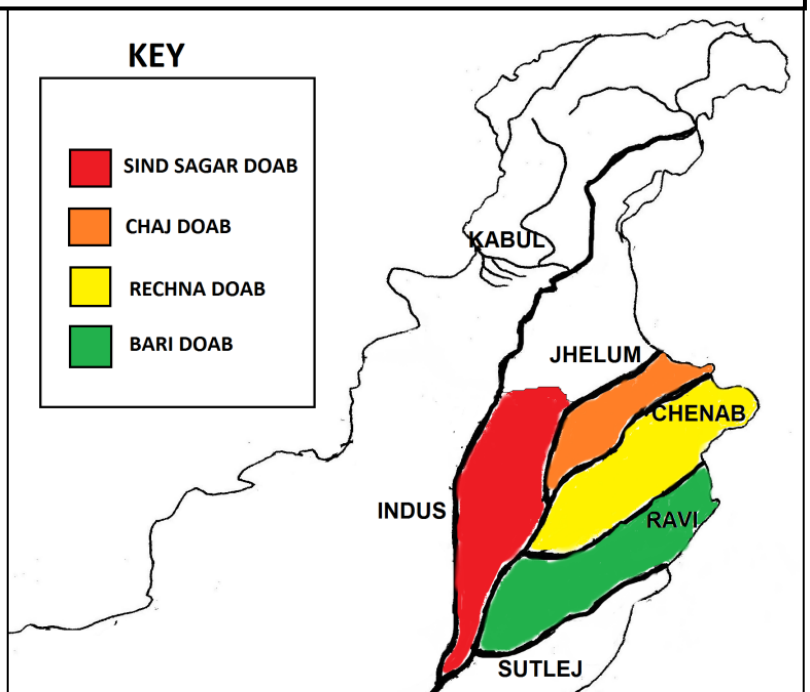
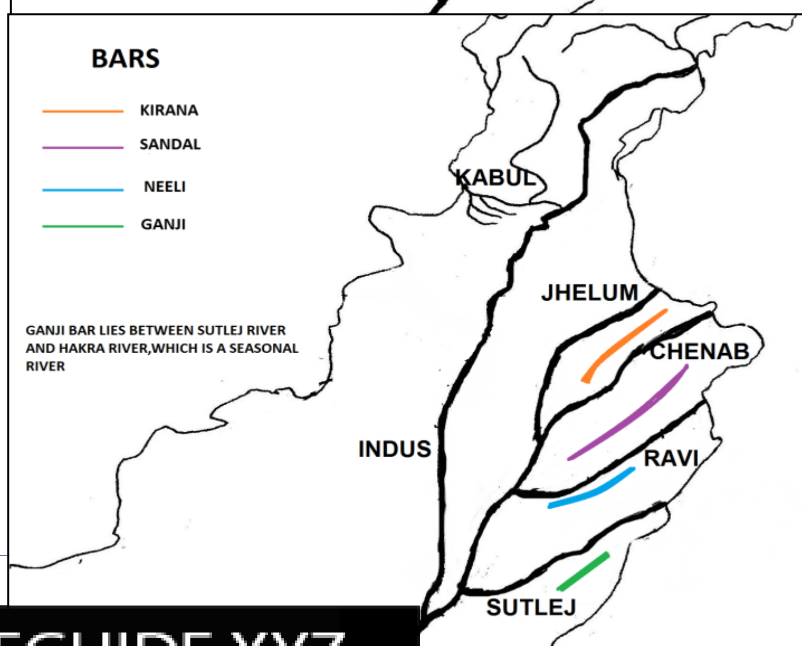


Fig 1.15

CHAJ doab lies between **CHE**nab and **J**helum rivers. **RACHNA** lies between **RA**vi and **CHENA**b rivers. **BARI** doab lies between **BEA**s and **R**av**I** rivers

Fig 1.16



Deserts

A **desert** is a place that receives very low amount of precipitation (less than 250mm). It is an area that can support almost no vegetation. Deserts can be cold as well as hot (have a high rate of evapotranspiration). Pakistan has 3 main deserts; the Thal, Tharparkar and the Kharan desert, all of which are hot deserts

Thal is found in Punjab between Jhelum and Indus Rivers.

Tharparkar is divided into 3 parts; Cholistan is found in Southern Punjab, Nara in Eastern Sindh and Thar in the South East of Sindh.

Kharan is found in Western Balochistan.

Topography

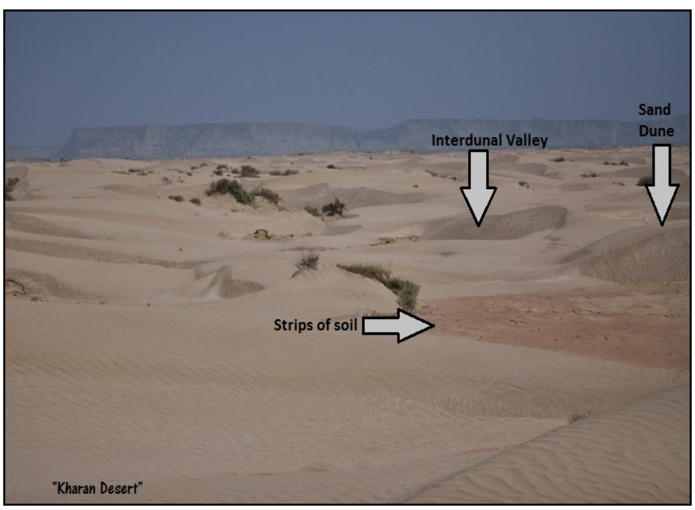


Fig 1.17

There are strips of soil found between sand dunes along with the sandy plains. Sand dunes shift grain by grain due to the pattern of the blowing wind. Sand dunes sometimes reach a height of 150m, and are both longitudinal and latitudinal in direction. All of the sand dunes are crescent shaped. When the wind blows away the top cover of sand away, bare and weathered rocks are exposed onto the surface

Desertification

Desertification occurs due to continuous land abuse. It is caused by both natural and man-made factors. Among the natural forces are continuous wind and water erosion (which erode the fertile topsoil so only few plants can then grow) along with long-term changes in rainfall patterns due to climate change (such as a drought). Human factors include overgrazing by animals, strip mining, the excessive usage of groundwater supplies and deforestation (mainly shrubs and wild grass)

AFFECT OF TOPOGRAPHY ON HUMAN ACTIVITIES

- **Mountains**

In the Northern areas of Pakistan life is at times harsh.

Food and fodder can only be grown in summers because the winters are too cold to support crop growth. Also, most of the soils are thin and infertile except for those in the valleys. Thus, the area available for crop growth is limited. Hence the stockpiling of food and maintenance of the stock becomes necessary.

Furthermore, animals must be kept in sheds during the winter. **Transhumance** is the practice of the seasonal movement of people with their livestock over relatively short distances, typically to higher pastures in summer and to lower valleys in the winters. During the summers, when the snow retreats from higher parts of mountain slopes; grass can grow as temperatures become warm and sunlight intensity and its duration increases. This comes at a time when the lower valley pastures have already been exhausted by the grazing animals during the winter.

As the winter starts, grass grows back in the lower valleys and the animals are moved back towards the valleys. Here they are kept in sheds (which also stores fodder etc). Their products like milk, meat, skins are utilized throughout the year

Other than that communication services are limited during the winters. There is a risk of sabotage by terrorists and damage by heavy flooding. Landslides frequently knock out communication poles. Roads are blocked by landslides and railway lines can be also blown away by avalanches. Building roads and railway is difficult due to steep slopes, narrow gorges and deep narrow valleys, which add to the construction time and cost. Sometimes heavy machinery can't be used as these machines cannot climb steep slopes. Many builders die due to landslides etc. Also in these sparsely populated areas there is a small pool of trained labour, which can build and maintain roads and railways etc.

On the other hand frostbite can occur and if not treated properly can result in death. People have to wear thick clothes and stay indoors to keep warm. They involve themselves in making crafts etc

Only in the summer months do these areas receive significant amount of tourists, which helps to increase the earnings of the local people (who are employed in hotels or sell ornaments etc)

- **Plains**

The plain areas of Pakistan consist of mainly Indus Plain and Kachi Sibbi Plain

These are fertile areas, where agriculture forms an important part of daily life. Almost ample land is available for crop growth and other such activities. Population density is high thus a large pool of trained labour is available. It is economical to build big schools, colleges and hospitals

Temperatures are also bearable although summers are a bit hot, so crops can be grown in both summers and winters. Water is available either from rivers or from wells/karez etc.

Since these are flat areas it is easy to build roads, railways as machines can be used. Thus the road and rail density is high. It is easy to transport goods etc.

Land for making factories and runways etc is also available, thus more commercial activities can be carried out. In Indus plain the bar upland is both flat and safe from flooding on account of its height and is perfect for buildings etc.

- **Deserts**

Deserts are vast expanses of barren land. It must be noted that here too both the topography and climate are rough.

Food can only be grown during the rainy season which brings less than 200mm of rainfall in only the wetter southern parts of the Thar desert.

People (nomads) have to move along with their animals and belongings in search of water (near oasis) and food/fodder. Water availability is a major hindrance to permanent settlement at a single place. Usually the people stay for some weeks at a place where there is food and water for livestock. In places of permanent settlement, embroidery and weaving etc is common

Alternating sand dunes mean that crop areas as well as roads and railways can be covered by sand completely in a matter of days. Thus before any such project is carried out the sand dunes are at first flattened, irrigation facilities are built up to grow certain trees and bushes whose roots prevent soil erosion. All of this is not cheap

Population density is low and there is **very small** pool of skilled labour **(don't write no pool of skilled labour)**, which can help in building and construction of buildings, roads etc. Also it is uneconomical to build roads and railways as they will be used very few people

Population density is low so there is less need for providing **major** health and educational facilities, although these facilities are **present but to a limited extent only**

- **Mangroves**

The presence of a delta means that there is a constant risk of flooding, which can inundate houses and sweep away crops and livestock

Furthermore there is **little** firm land **(don't write no firm land)** to build houses and factories upon. Ground water is salty and is not fit for agriculture. The soil is also too wet due to constant flooding and thus contains little air (there are pores in-between the soil particles which contain air and are necessary for plant growth)

Population density is low so there is less need for providing **major** health and educational facilities, although these facilities are **present but to a limited extent only**

CLIMATE OF PAKISTAN

2



*Factors Affecting Climate

*Rainfall and it's types

*Climatic Zones of Pakistan

*Distribution of Rainfall

*Climatic Hazards

ACKNOWLEDGEMENTS

Fig2.1

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Fig2.2

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Fig2.3

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Fig2.4, 2.5 and 2.6

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Fig2.19

NASA GSFC LaRC JPL, MISR Team

Thank you Joseph Casey for providing the data on the climate graphs

❖ Definition

Weather refers, generally, to day-to-day temperature and precipitation activity, whereas climate is the term for the average atmospheric conditions over longer periods of time (30 years etc)

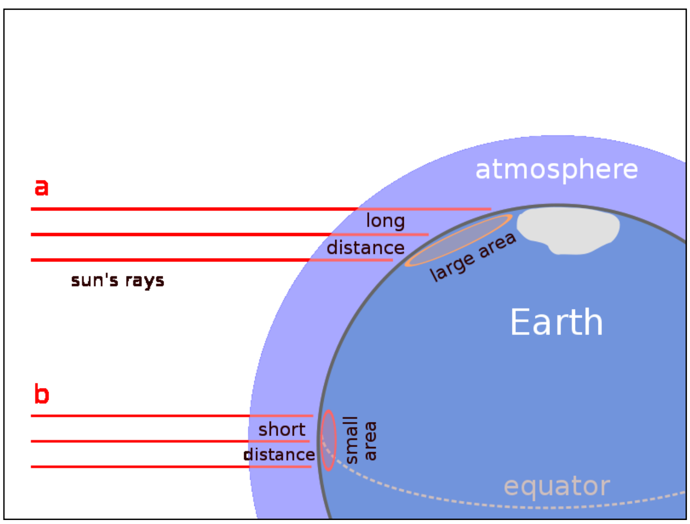
Factors Affecting Climate

➢ Temperature

- **Angle of Sun**

Temperature and rainfall are both dependent either directly or indirectly on the influence of the sun. The sun's influence varies from place to place due to factors like angle of sun at a particular place. So during the Equinox (when earth has no tilt relative to the plane of its orbit), Moscow for example will be cooler than say Lahore (when keeping other factors like the day of the year, influence of water bodies constant etc)

Fig2.1



As it is evident the Polar Regions or regions far away from the Equator are generally cooler than the ones nearer the Equator. This is because for solar radiation to reach the poles and heat them it has to travel a larger distance in space, thus it loses its intensity (energy). Also near the poles the radiation arrives at an oblique angle so solar energy spreads over a large area. Since Pakistan lies in subtropical areas it does receive most of intense solar radiation concentrated on a small area thus the temperature in general is warmer. So in general terms Faisalabad will be cooler than say Hyderabad

- **Influence of large water bodies**

Water has a high specific heat capacity as compared to land, meaning that water has to absorb more heat to have an increase in temperature as compared to land. Thus land gets hotter quickly than sea etc. Since the land gets hot quickly, the air over it also absorbs heat and gets less dense. This hot air rises and creates a low pressure. The sea on the other hand absorbs less heat and moist air over it gets less hot. Thus it is denser as compared to the air over land and doesn't rise as much as the air over land does, which results in the persistence of high pressure over the sea. Winds travel from high pressure area to low pressure area, thus in this case wind blows from sea towards land. This is known as a sea breeze, which is **cool** and **moist**

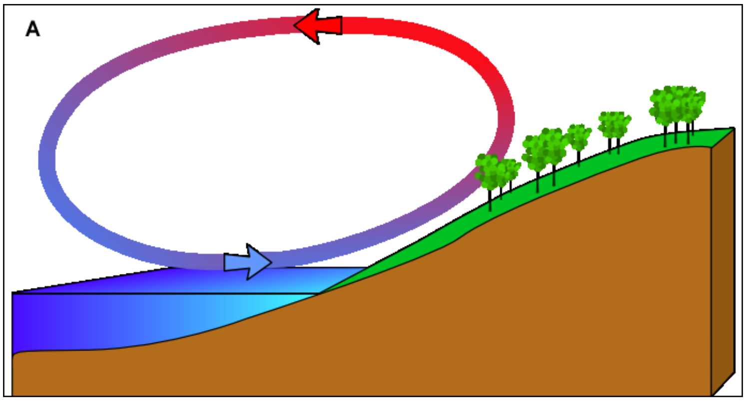


Fig2.2

On the contrary at night when there is no solar radiation, the land looses heat quickly and air over it gets cooler and denser. The sea retains its heat and air over it is generally hotter and less dense. So a land breeze occurs when wind blows from land to sea

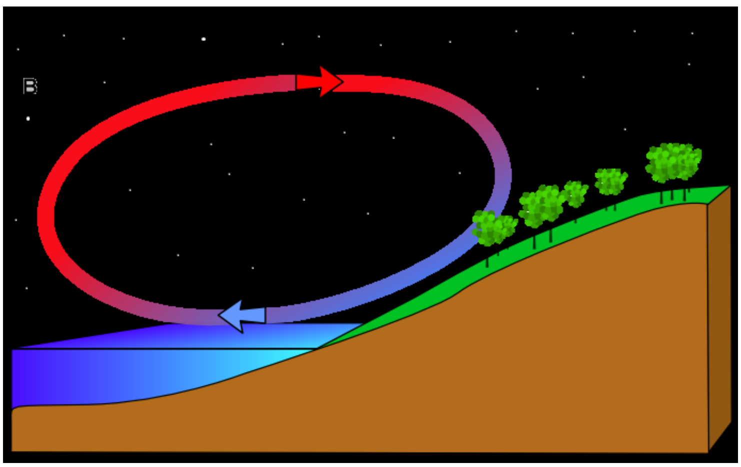


Fig2.3

During the summers, the land is much hotter than the Arabian Sea, thus convection currents of air are setup. Cool air from sea flows inland thus **regulating** the temperature and making summers a bit cooler than it would have been without the influence of the sea

In winters, the sea retains its warmth and thus cold air from coastal areas flows towards sea. To replace the air in coastal areas whose rising has created a low pressure, **dry warm** air from interior Sindh and Punjab flows towards the coast, thus making winters less cold than they would have been without the influence of the sea

If an area doesn't experience moderating affect of sea then it has a **continental climate**, which is characterized by hot summers and cold winters. **USUALLY THOUGH NOT ALL THE TIMES, most** of the rainfall in these continental climate areas occurs in the winters

- **Altitude**

Altitude also has a big impact on the average temperatures experienced by an area. The solar radiation is a short-wavelength radiation, which does not heat the atmosphere directly when it passes through it. This is because it is poorly absorbed by the air particles (gases and water vapours). Instead the atmosphere is heated from the bottom by long-wave radiation from the earth's surface. The Earth's surface reflects the short wavelength radiation as long wavelength radiation. This long wave radiation is better absorbed by gas molecules and water vapours as compared to the short wavelength radiation.

The temperature of the atmosphere decreases with increase in altitude, as short wavelength has to pass its heat to a lot of air particles to transfer heat to the high altitude areas. Also as the altitude increases the amount of atmosphere decreases (air gets thinner and thinner), thus there are less gas molecules and water vapours present to absorb the long wavelength radiation.

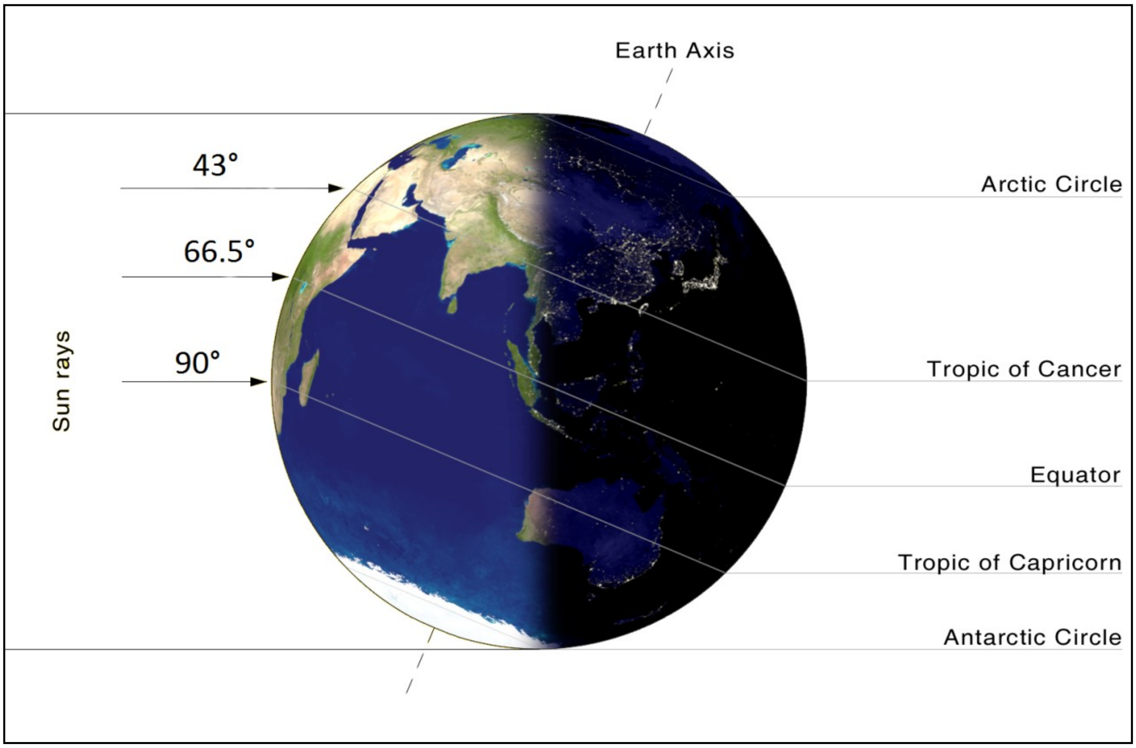
Thus overall a smaller proportion of the total heat energy is passed on to the higher parts of the atmosphere

On average dry air loses around 9.8 °C per every Km rise in height, meanwhile moist air loses around 10 °C for every Km rise in height

- **Valley**

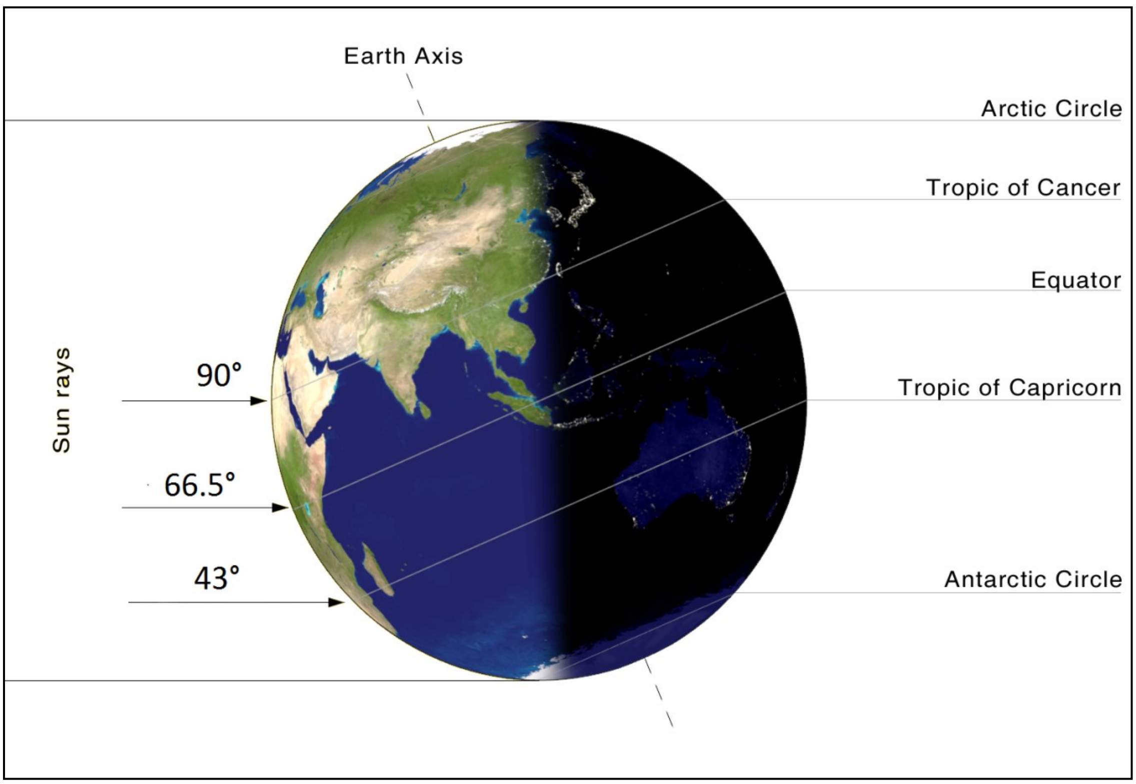
Most of the sun's rays are blocked from reaching the lower parts of valleys due to the presence of mountains, which surround the valley. This lowers the average temperatures of these valleys, as less solar radiation reaches the surface of the valley to be reflected and then absorbed.

- **Tilt of Earth**



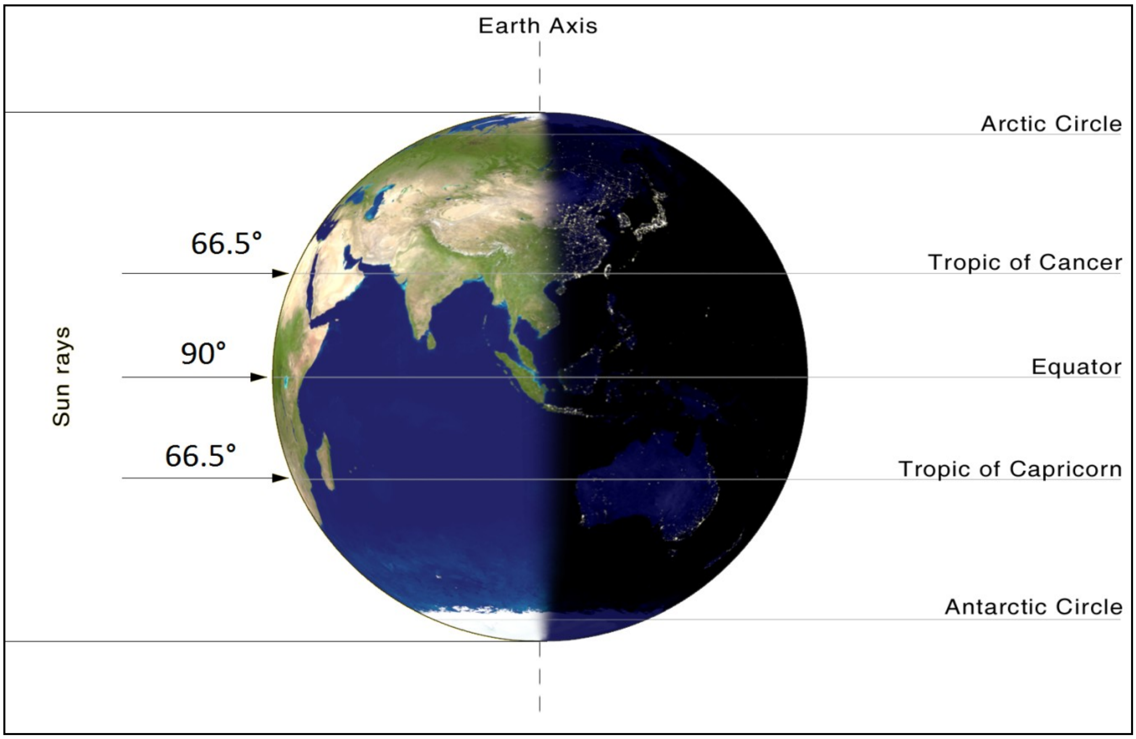
21st December

Fig2.4



21st June

Fig2.5



21st March and 21st September

Fig2.6

During the winter solstice (21st December), the Sun is directly above the Tropic of Capricorn, which passes over Australia. So areas which are far from Tropic of Capricorn receive less direct sunlight. Areas of Pakistan, which are far inland (Faisalabad) experience cold weather meanwhile areas which are near the coast (Hyderabad) receive more direct sunlight and are generally hotter

During the summer solstice (21st June), the Sun shines directly above the Tropic of Cancer, so areas which are near to this Tropic (like Karachi); they receive a lot of sunshine. If it were not for the moderating influence of the sea, temperatures there would have been high like those found inland like Thatta and Jacobabad; hovering at summer highs of 50°C plus.

During the Equinox (21st March and 21st September), the sun is directly above the Equator. Equatorial areas experience high temperatures. In Pakistan, temperatures are midway between those in summers and winters.

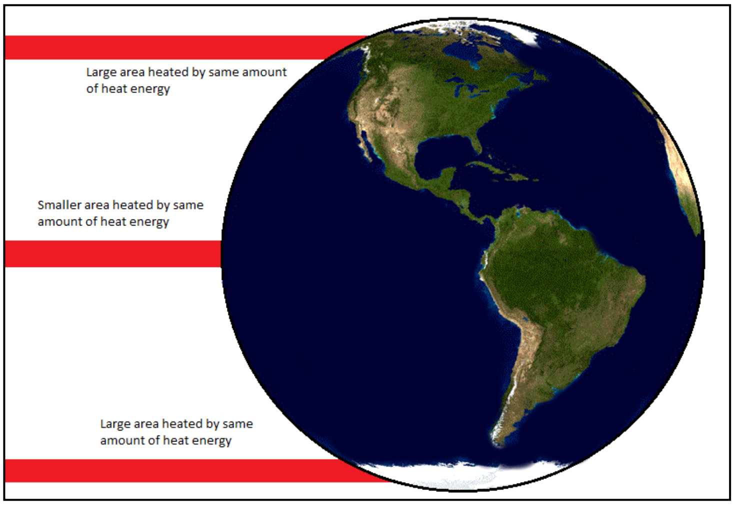
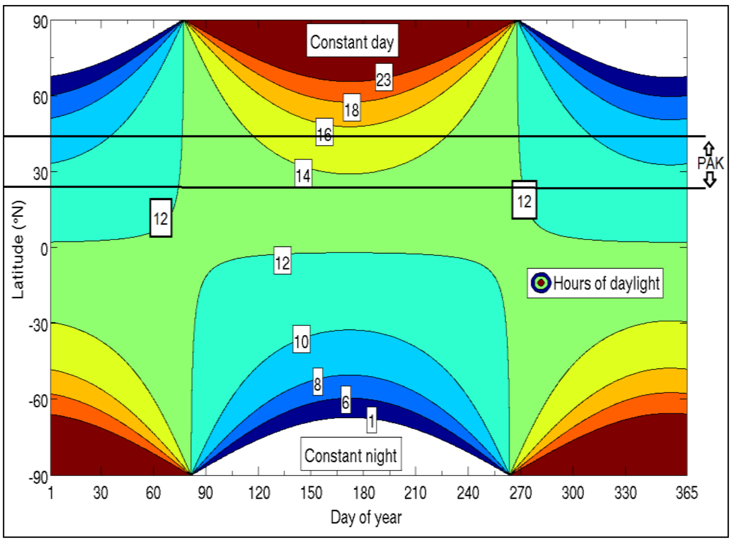


Fig2.7

Fig2.8



Longitude on its own as such doesn't have an effect on the climate

- **Cloud Cover**

Temperatures decrease when clouds appear and block out the Sun's rays, which are then reflected back into space. However cloud formation only takes place when air contains sufficient moisture and has been sufficiently cooled. Thus cloudy days are much cooler than sunny days during the same months.

However cloudy nights are hotter than cloudless nights because the clouds trap heat inside the Earth's surface. This heat is easily radiated back to space when no clouds exist but when they do exist this heat is reflected back onto the Earth's surface.

These two reasons help us explain why a day in desert is very hot 50°C but night is cool/cold 5°C

Explained on the next page in detail

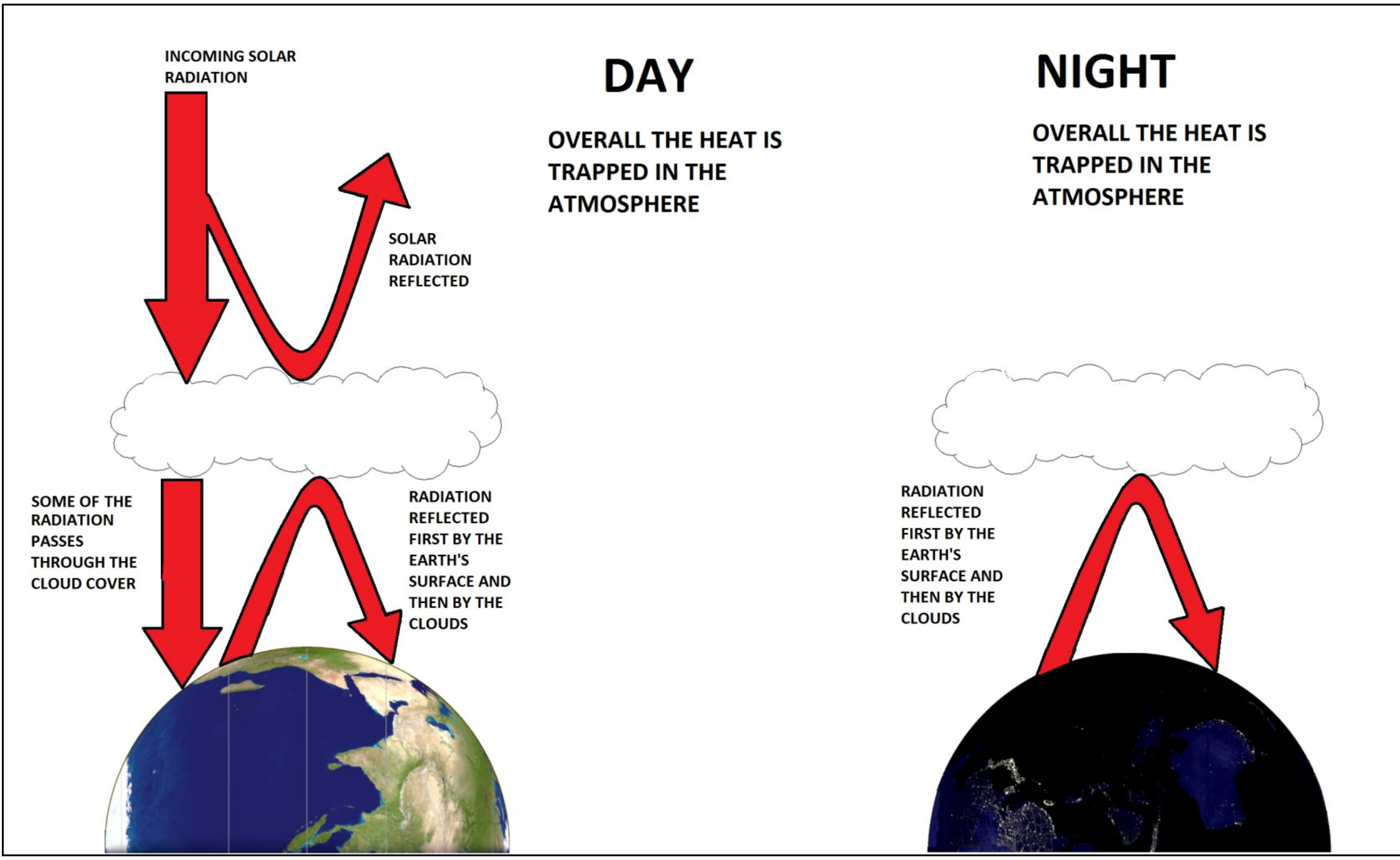


Fig2.9 **CLOUDY**

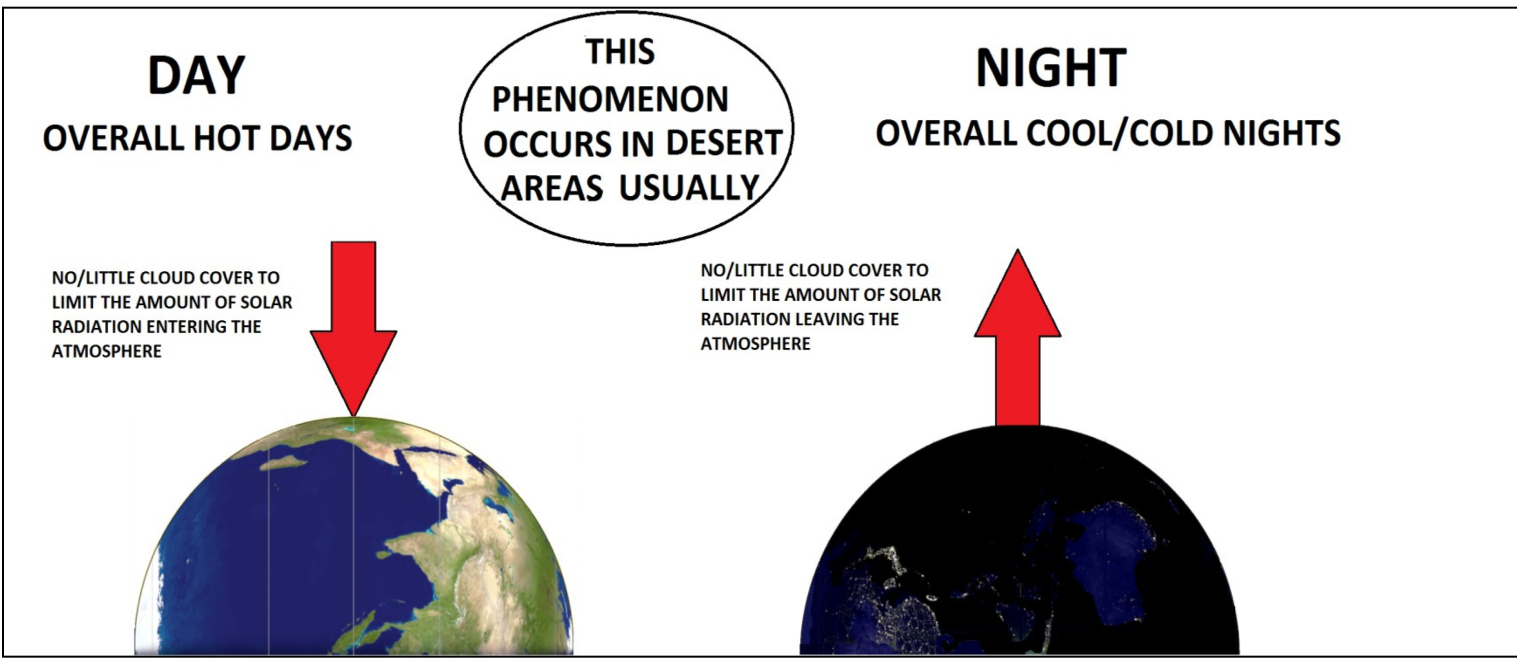


Fig2.10 **NON-CLOUDY**

➢ Rainfall

- **Monsoon Rainfall**

Monsoons are seasonal winds that blow from sea towards land from July to August (summers). After it they reverse their direction and blow from land towards the sea (winters).



Fig2.11 **NASA**

During the summers due to the high angle of sun, Punjab and Sindh plains get heated up, thus an area of very low pressure develops here as the hot air rises. There are two monsoon systems, one originating from the Bay of Bengal and other from the Arabian Sea. **Moist** laden winds from **high pressure** areas of sea blow towards land. From the east the monsoon clouds are deflected along the Himalayas from Nepal to Pakistan. Along the way these clouds rise, cool and thus condense eventually bringing rainfall to Pakistan. They affect northern Punjab, Khyber-Pakhtunkhwa, Gilgit-Baltistan and Azad Kashmir

On the other hand another monsoon system that originates in Arabian Sea also travels inland but doesn't bring significant rainfall to areas of Sindh because of a temperature inversion layer

- **Temperature Inversion layer in southern Sindh**

A temperature inversion layer exists over Sindh and areas of Makran coast during the monsoon season (July-August), around the height of 1-2 km [1]. The presence of this layer means that moist air is not allowed to rise due to presence of dense cold air above. This cold air is part of a global wind system which exists due to the spinning of Earth and various other factors. Thus the moist air cant rise further so can't be cooled and as a result these areas receive little rainfall during the monsoons.

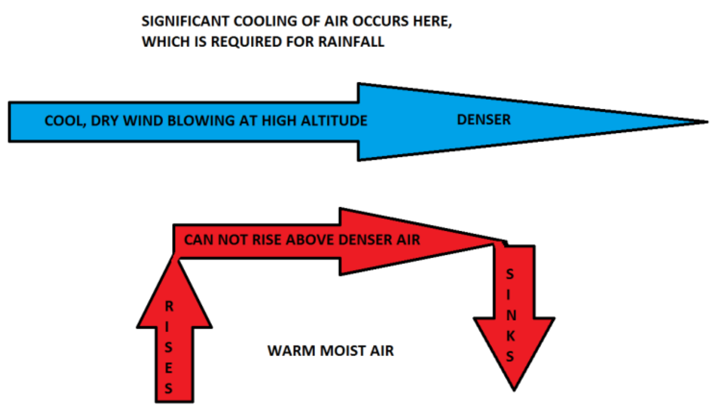


Fig2.12

- **Western Depressions**

These are wind systems that originate from the Mediterranean Sea and travel eastwards towards Afghanistan and Pakistan. Since they make a long journey they lose most of their water when they reach Pakistan. During the winters (Late November to March) they bring rainfall because during winters the Arabian Sea retains its warmth and thus cold air from coastal areas flows towards sea. The flow of air from coastal areas creates a low pressure, thus dry colder air from interior Sindh and Punjab flows towards the coast. To replace the low pressure formed in Punjab and Sindh plains, these western depressions move from high pressure area (Mediterranean Sea) towards the low pressure area (Indus Plains)

- For rainfall or liquid precipitation to occur two things are necessary. First is moisture in air and second is the **sufficient cooling** of air. If the air is very humid then it has a lot of water vapour in it and if it condenses then rainfall will occur. Secondly, the air must rise into higher parts of atmosphere to be cooled, which results in cloud formation. Clouds contain liquid water but it won't fall as rain until the rain drops overcome resistance from air. Simply put until and unless the raindrops are heavy they won't fall. Raindrops get heavy only when sufficient moisture is present in the air (clouds), so these drops could then merge together to form bigger water droplets. Also a very humid air unless cooled wont condense as rain as the formation of a liquid is necessary. Liquids have densities higher than gases, so per volume liquids are heavier than gases

Types of Rainfall

- **Convection**

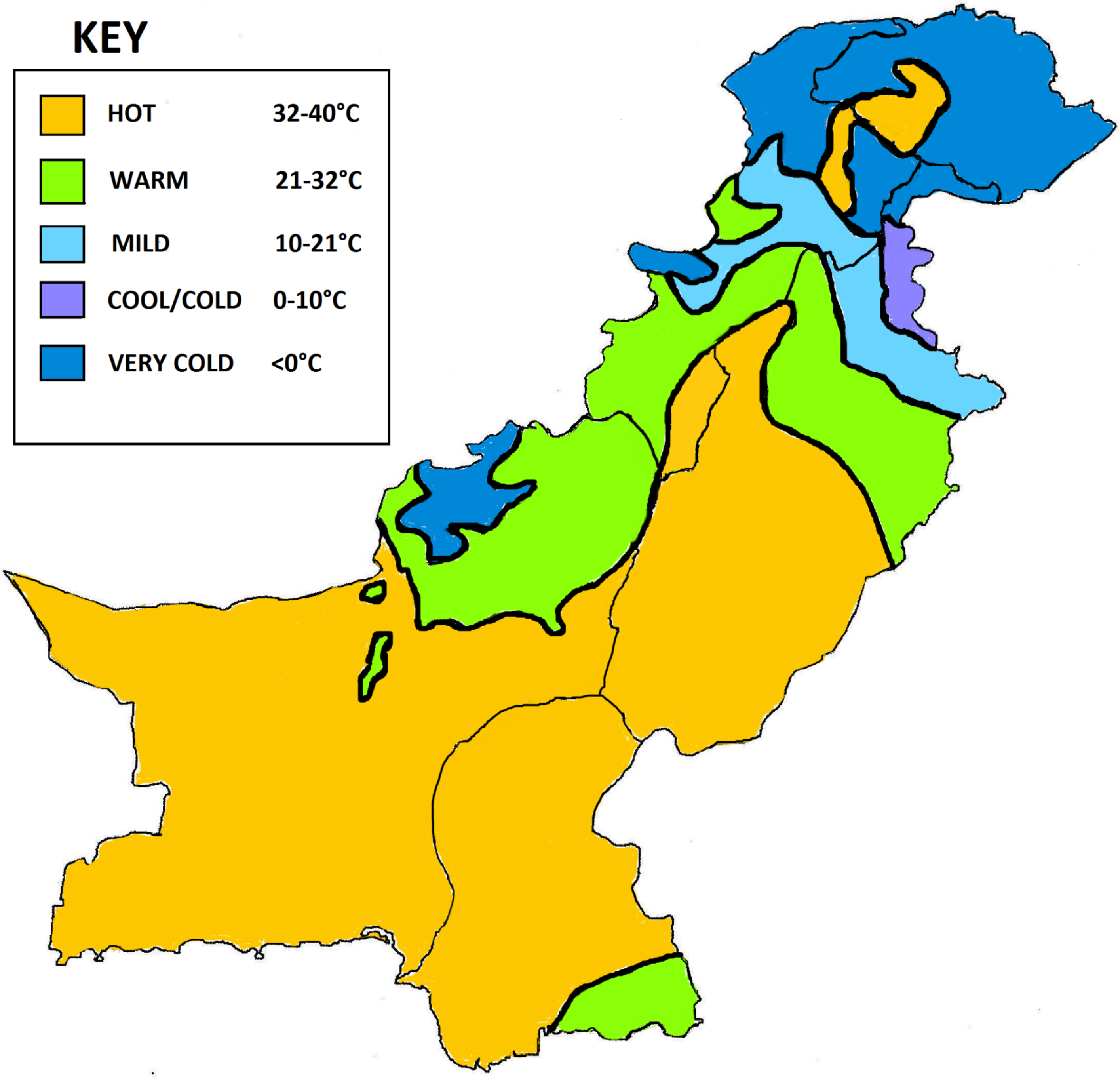
Convection rainfall occurs when the sun heats up the land. The air near the land absorbs heat by conduction, and thus gets less dense and rises. The moisture in air condenses to form clouds, and when this air is cooled to a certain minimum level rainfall occurs

- **Thunderstorm**

Thunderstorms occur in the same fashion as convectional rainfall with the main difference being that the air here rises very quickly forming Cumulonimbus clouds, which are very tall and big. This is followed by strong winds, lightning and heavy rainfall. Hailstones may also be formed, when the water vapours are cooled multiple times (to form water first and then ice).

- **Cyclone**

Cyclones are formed when the average temperature of large water body exceeds 27° C, thus forming an area of very low pressure. This area then draws further air from high pressure areas quickly. A cone is formed when two oppositely travelling cold and warm winds meet. Intense lightning followed by very strong winds and heavy rainfall occurs. Their effects are similar to that of floods (explained later in this chapter)



IN EXAM PLEASE DO NOT WRITE THAT LAHORE EXPERIENCES WARM ANNUAL AVERAGE TEMPERATURE WITHOUT GIVING THE TEMPERATURE RANGE , OTHERWISE YOU WILL NOT GAIN CREDIT

Fig2.13

Average temperatures annual

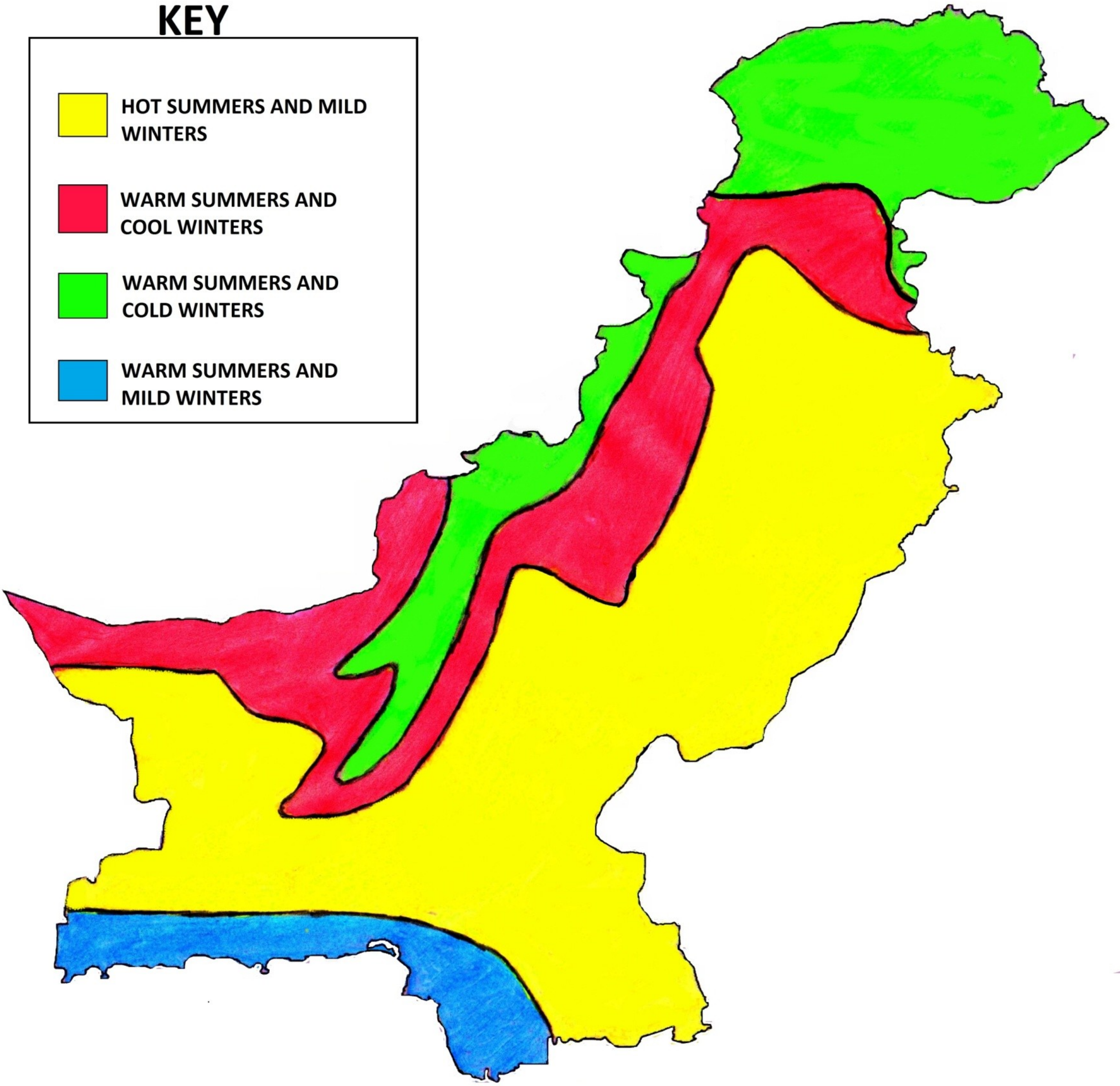


Fig2.14

Pakistan is divided into 4 climatic zones as shown above

- ***Hot summers and Mild winters***

This covers almost whole of Punjab, most of interior Sindh, and central and eastern Balochistan.

The climate is characterized by hot (32-40° C) summers. Summers are longer than winters. In Upper Indus Plain thunderstorms form during March-April. Rate of evapotranspiration is high and hot winds are common during May-June. Rainfall mainly occurs through monsoons but convectional rainfall also occurs in March and September. Precipitation is only in form of rain. There is a

difference of temperature between day and night (this gives maximum and minimum temperatures in the day). A large daily range of temperature exists. Also there is a difference in temperature between sun and shade. Temperatures are high as Sun is directly above Tropic of Cancer, altitude is low and there is no moderating influence of the sea

Mild (10-21° C) winters exist. Rainfall is mainly through Western Depressions and is in form of mostly rain except for few northern hilly areas where snow can occur. There is a difference of temperature between day and night (this gives maximum and minimum temperatures in the day). A large daily range of temperature exists. Also there is a difference in temperature between sun and shade. Temperatures are mild because altitude is low, Sun is away at Tropic of Capricorn and that there is no moderating influence of any large water body

There is **generally** decreasing rainfall as we move down the Indus Plains, and also decreasing rainfall if we move from east to west in Balochistan

- ***Warm Summers and Mild Winters***

This includes the entire coastal belt of Pakistan. Warm summers (21-32° C) exist. Summers are longer than winters. Precipitation is in form of rain only and comes from Arabian Sea wing of Monsoons affecting the Sindh coast. There is a difference of temperature between day and night (this gives maximum and minimum temperatures in the day). A large daily range of temperature exists. Also there is a difference in temperature between sun and shade. Temperatures are less hot than the Indus Plain because of the influence of the sea which counteracts the influence of the Sun. Sun is directly above Tropic of Cancer, which is near the coast but its effect is nullified by the moderating influence of the Arabian Sea. The altitude is low too

Mild winters (10-21° C) exist due to moderating affect of sea as explained on previous pages. Also this area is closer to Tropic of Capricorn, around end of the year 21st December. Also since altitude is low the temperature rarely plummets below freezing. Precipitation is in form of rain only. Rainfall occurs through Western Depressions in the Makran coast

It is interesting to know that the Monsoon does not affect the coastal areas of Balochistan. This is because the coastal areas of Makran are preceded by Makran Coastal Range and other ranges, which form the Balochistan Plateau. Since these ranges have high altitude, the temperature persisting there in summers is low as compared to interior Sindh and Punjab thus a very low air pressure doesn't develop in interior Balochistan and thus monsoon clouds do not affect that area while Western Depressions coming in from the opposite side do affect the Makran Coast. There is a difference of temperature between day and night (this gives maximum and minimum temperatures in the day). A large daily range of temperature exists. Also there is a difference in temperature between sun and shade

- ***Warm Summers and Cool Winters***

This includes part of Balochistan Plateau, Chagai Hills and beyond, the areas of high altitude in Khyber-Pakhtunkhwa.

Warm summers (21-32° C) exist. In summers, rainfall comes to parts of Khyber-Pakhtunkhwa from monsoons and convection like in Peshawar. Thunderstorms are also common. Precipitation is mainly in form of rain and rarely in form of snow. There is a difference of temperature between day and night (this gives maximum and minimum temperatures in the day). A large daily range of temperature exists. Also there is a difference in temperature between sun and shade. These areas are relatively colder than Indus Plain because of their height.

Winters are longer than the summers, and are cool (5-10° C). Rainfall is received throughout these areas from Western Depressions and is mainly in form of snow on mountain tops and valleys. Precipitation is in form of snow because of low temperatures, which are caused by high altitude. Sometimes precipitation is in the form of rain in valleys. There is a difference of temperature between day and night (this gives maximum and minimum temperatures in the day). A large daily range of temperature exists. Also there is a difference in temperature between sun and shade

Generally as we move south rainfall decreases from 250mm to 125mm because during the way rain systems lose most of their moisture due to the increasing distance

- ***Warm Summers and Cold Winters***

This includes a small part of Balochistan Plateau, parts of Waziristan Hills, Safed Koh Ranges, almost whole of Azad Kashmir and Gilgit-Baltistan

These are areas of very high altitude where the mountain tops (above 4000m) are below freezing in winters and in summers too. As altitude increases temperature plummets. For every 100m rise in altitude there is an average drop of 1°C fall in temperature in Pakistan. There is a difference of temperature between day and night (this gives maximum and minimum temperatures in the day). A large daily range of temperature exists. Also there is a difference in temperature between sun and shade. Temperatures are relatively cooler than the Indus Plain because of the decreasing influence of the Sun; as we are moving away from the Tropic of Cancer. So here Sun's rays strike at an oblique angle and transfer less of their solar energy in the form of heat

Winters are longer than the summers. Warm summers (21-32° C) exist and precipitation is mainly in form of rain in summers. In Northern Mountains rain come from monsoons and convection in summers while Western Depressions bring rain in winters. Some areas in Karakorum receive less rainfall due to being rain shadow areas

Cold winters (0-5° C) exist and precipitation is mainly in form of snow in both valleys and mountain tops. There is a difference of temperature between day and night (this gives maximum and minimum temperatures in the day). A large daily range of temperature

exists. Also there is a difference in temperature between sun and shade

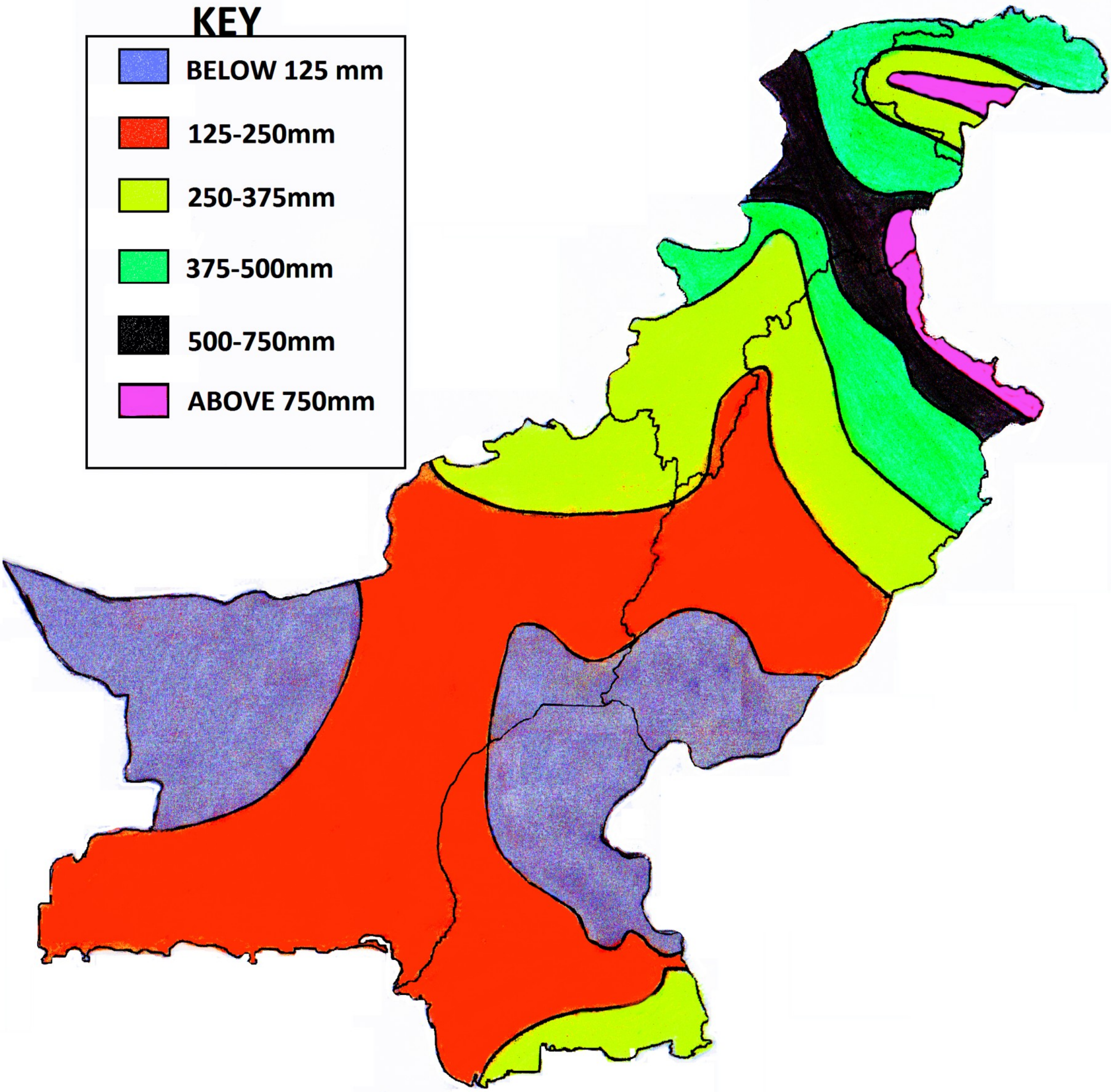


Fig2.15

Distribution of Rainfall

- **Below 125mm**

Southern Punjab and parts of Nara and Thar receive less than 125mm of rainfall along with areas of Kharan desert in Balochistan. Parts of Tharparkar desert receive low rainfall as they are out of **significant** influence of the Western Depressions (as this area is far east) and also the Monsoons, which generate in Bay of Bengal (too south) and other in the Arabian Sea (too north). These areas are generally dry and thus don't receive any convectional rainfall (this rainfall firstly requires surface water to rise and cool to condense to result in rain eventually).

Kharan desert is also rainshadow area, as mountains in Afghanistan receive most of rainfall from Western Depressions thus they are robbed of their moisture upon reaching

western Balochistan. Also, high pressure exists in high altitude ranges like Coastal and Central Makran Ranges, which are between Arabian Sea and Kharan Desert. This high pressure prevents any Monsoon system from affecting interior Balochistan and its coast

- ***125-250mm***

This includes most of coastal areas of Pakistan, interior Sindh, eastern and central Balochistan along with central Punjab. In this climatic zone humidity generally increases as we move from north to south. Here areas in Sindh fall under influence of Arabian Sea wing of Monsoons but since a temperature inversion layer exists at this latitude in higher parts of atmosphere, most of moisture isn't allowed to condense. The areas in Balochistan like the Makran Coast do come under influence of Western Depressions and have only winter rainfall. Otherwise all other areas in this region are deprived of Western Depressions as they are rainshadow areas (depressions are deflected by Chagai Hills ranges etc, which ring Pakistan/Afghanistan border in this area). The areas in Punjab are under weak influence of Monsoons, which had originated from Bay of Bengal

All of these areas are dry areas thus there are almost non-existent sources of moisture present for the formation of convectional rainfall

- ***250-375mm***

This includes areas in Khyber-Pakhtunkhwa, northern Balochistan, small southeastern part of Sindh and part of north-central Punjab. All of the areas here except one in Sindh receive rainfall from Western Depressions. Western Depressions on average bring more rainfall to north western parts of country as compared to south western as there are more flat and hot areas east of Khyber-Pakhtunkhwa like Punjab. This allows for a rapid build up of low pressure areas due to intense heat, this acts like a magnet for monsoon systems etc. The southeastern part of Sindh is affected by Arabian Sea branch of monsoon only as it is too south for Bay of Bengal ones. While areas of Punjab and Khyber-Pakhtunkhwa except Balochistan, are affected by Bay of Bengal branch of monsoons

- ***375-500mm***

This includes areas in central and northern Khyber-Pakhtunkhwa, western Gilgit-Baltistan and parts of northern Punjab. These are areas which fall under moderate influence of both Western Depressions and Bay of Bengal branch of Monsoons. Since they are in northern areas they can receive rainfall from both these systems

- ***500-750 + mm***

  These are areas of mostly northern Punjab and eastern Khyber-Pakhtunkhwa which fall under heavy influence **generally** of **both** Western Depressions and Bay of Bengal branch of Monsoons. Since these are mountainous areas in direct pathways of both monsoons and western depressions, there is maximum chance of relief rainfall occurring too

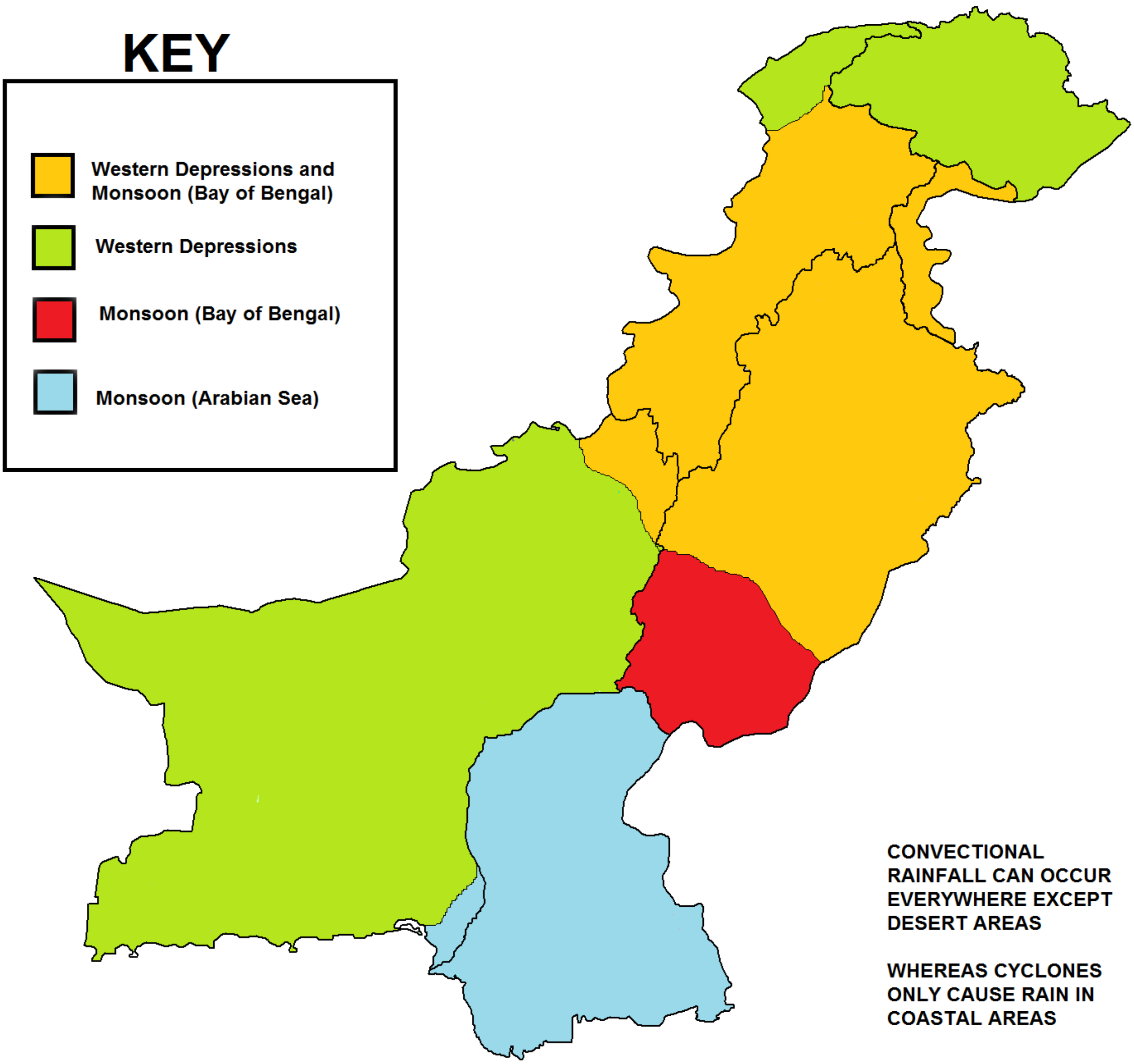


Fig2.16

This map does not mean that Western Depressions don't reach Sindh, they go as east as Delhi and as south as Karachi. What this does mean is that significant amount of rainfall in these areas occurs from the mentioned source rather than any other source, so all of Sindh receives **significantly much much** more rain from Monsoon (Arabian Sea wing) rather than from Western Depressions.

Usually they Bay of Bengal wing of Monsoons are much powerful than the Arabian Sea wing, thus the Bay of Bengal wing brings much more rainfall as compared to the Arabian Sea wing

We can see (map on next page) that Lahore, Islamabad, Multan, Hyderabad, Karachi and Peshawar all receive rainfall in July-August from Monsoons. They also receive rainfall from convection during the inter monsoon-western depression season (March-June and August-November)

Also Quetta, Peshawar, Islamabad, Lahore and Jiwani (Makran Coast) receive rainfall from Western Depressions. The amount of rain from both Western Depressions and Monsoons, decreases as we move from north of Pakistan towards the south. They also receive rainfall from convection during the inter monsoon- western depression season (March-June and August-November)

Almost all of the cities stated above receive rainfall from thunderstorms which are a form of convectional rainfall around March. This is because around this time of year the Sun heats up the land and the moisture in it rises quickly to form big clouds bringing rain, strong winds and lightning

It must also be noted that areas in north like Chitral are rainshadow areas and thus receive less rainfall from both Western Depressions and Monsoons than they would have if the path of clouds hadn't been blocked by mountains (see figure 2.17)

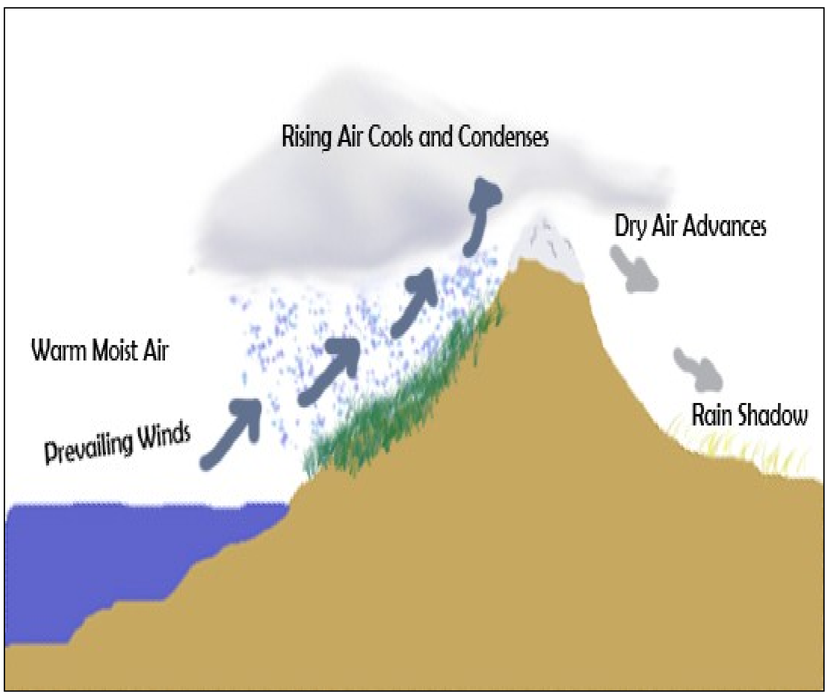


Fig2.17

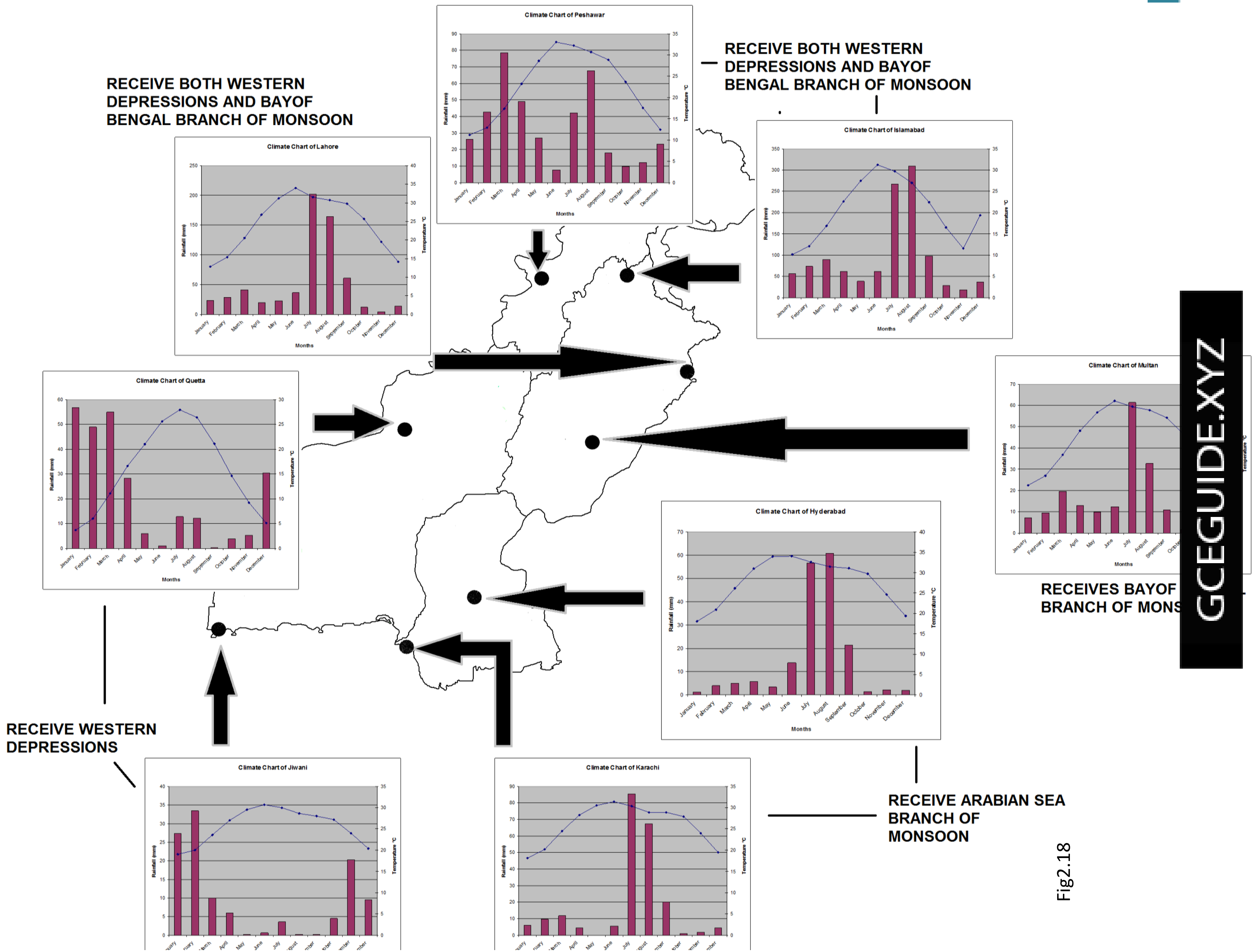

RECEIVE BOTH WESTERN DEPRESSIONS AND BAYOF BENGAL BRANCH OF MONSOON
Climate Chart of Lahore
Climate Chart of Peshawar
RECEIVE BOTH WESTERN DEPRESSIONS AND BAYOF BENGAL BRANCH OF MONSOON
Climate Chart of Islamabad
Climate Chart of Quetta
Climate Chart of Multan
RECEIVES BAYOF BRANCH OF MONS
Climate Chart of Hyderabad
RECEIVE WESTERN DEPRESSIONS
Climate Chart of Jiwani
Climate Chart of Karachi
RECEIVE ARABIAN SEA BRANCH OF MONSOON
Rainfall (mm)
Temperature °C
Months

Fig2.18

Description of Rainfall

- First name the months which have the highest and lowest rainfall respectively
- Name the season (summers/winters) during which most of rainfall is received along with the source of rainfall for both summers and winters (Monsoons and Western Depressions)
- Also tell whether any rainfall occurs in spring and autumn due to thunderstorms etc

CLIMATIC HAZARDS

❖ Floods

Flood is a temporary covering of land by water which is not usually under water. They can be caused by variety of factors like

Heavy monsoon rainfall accompanied with melting of snow and ice in glaciers, dam or barrage failure, unusually high tides in coastal areas and by a tsunami

However their effects can be exacerbated by factors like deforestation, failure to heighten or strengthen embankments, poor medical and communication facilities in aftermath of disaster and inadequate warning systems to allow people time for escape. Benefits of floods are limited to restoring underground water supplies, filling reservoirs of dam and laying down a fresh layer of silt on the inundated soil; which makes the soil fertile

Effects

❖ Primary

Physical damage - Can damage any type of structure, including bridges, cars, buildings, sewer systems, roadways, and canals

- Casualties - People and livestock die due to drowning. It can also lead to epidemics and waterborne diseases.
- Suspension of Trade- Airports can be closed (businessmen can be affected), roads and railway lines severed causing disruption to supplies of raw materials and products etc

❖ Secondary

- Water supplies can be contaminated.
- Spread of water-borne diseases. This could pose a serious danger to health of people who are affected
- Crops can be washed away, thus leading to food shortages.
- There could be a shortage of supplies to agro-based industries, like shortage of raw cotton to cotton factories. These factories thus won't be able to fulfil their orders and will lose customers. To reduce their operating costs they will lay off workers causing unemployment and their own profits will decrease
- Silt deposited by floods adds nutrients to the flooded soil
- *Trees* die as their **submerged** roots can't absorb oxygen

❖ Tertiary/long-term

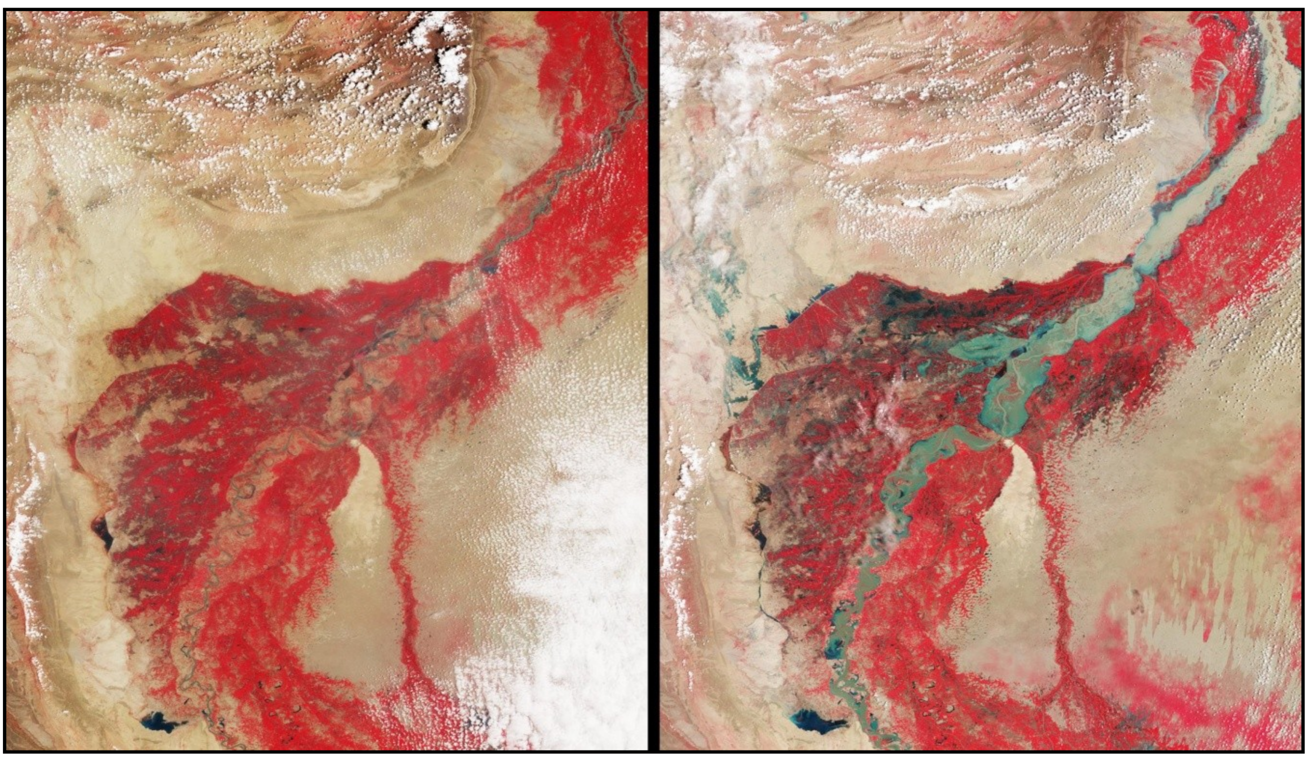
- There could be a decline in tourism, rebuilding costs could soar etc

Reducing Effects of Floods

- Dams could be built to contain and regulate the flow of water and prevent flash floods
- Advanced warning systems should be installed in flood prone areas to warn people to get out before it's too late
- Medical and transport facilities be regularly updated and checked
- Embankments and levees should be heightened and strengthened
- Also afforestation and re-afforestation projects should be carried out in Northern Mountains to reduce run-off and thus reducing chances of flash floods
- Mangrove plantations should be protected and allowed to grow, which protect from damaging rise in tide level during a tsunami

Fig 2.19 Indus in July 2009 (left) and in July 2010 **NASA**

The very pale blue curly line in left photo is the river Indus (2009). Vegetation has been artificially coloured red by the satellite



❖ Drought

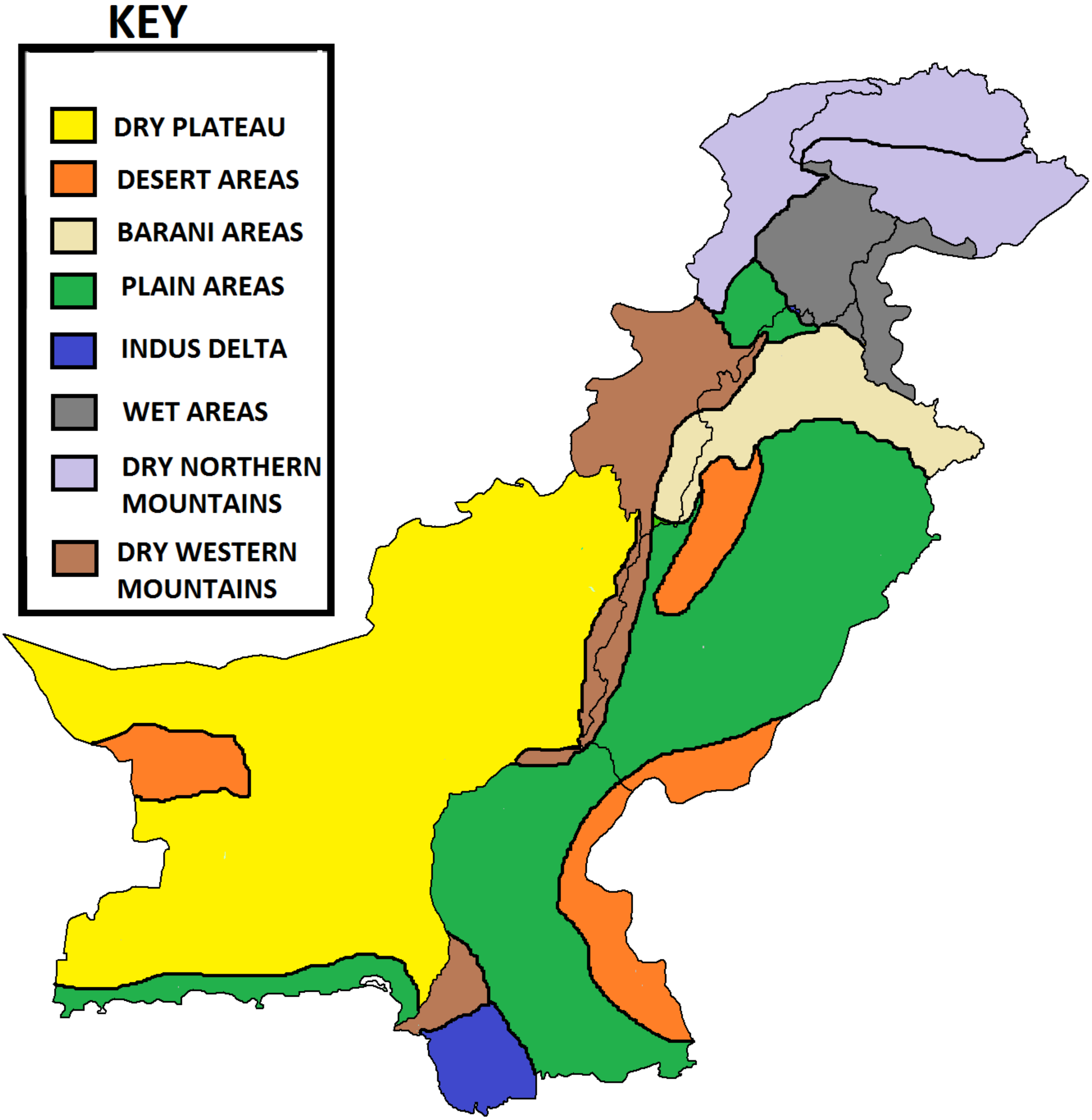
A drought is a period extending over several months or years when a region suffers a deficiency in its water supply. This occurs when a region receives below than average precipitation over a period of time

❖ Types

- **Meteorological** drought is brought about when there is a prolonged period with less than average precipitation.
- **Agricultural** droughts are droughts that affect crop production. This condition can also arise independently from any change in precipitation levels when soil conditions and erosion triggered by poorly planned agricultural endeavours. These cause a shortfall in water available to the crops.
- **Hydrological** drought is brought about when the water reserves available in sources such as aquifers, lakes and reservoirs fall below the statistical average.

❖ Effects

- Crop yields can be dramatically reduced and livestock production could fall (milk, eat etc). This can raise prices of goods and affect price of exported goods making them uncompetitive in international markets thus harming national interests
- Dust storms can occur, when drought hits an area suffering from desertification and erosion. This can lead to siltation in reservoirs of dam, hampering electricity generation and weakening dam's foundation
- Habitat damage, affecting both terrestrial and aquatic wildlife
- Malnutrition, dehydration and related diseases could affect millions
- Mass migration causing the increase in internal refugees or international refugees
- Reduced electricity production could occur as reduced water flow through hydroelectric dams leads to low industrial production and less exports resulting in less foreign exchange
- Shortages of water for industries like (juice etc), which affects employment and GDP
- Social unrest may follow leading to instability, which can discourage foreign investment thus local sectors may suffer from outdated machinery techniques etc resulting in low production
- War could occur over natural resources, including lakes and fertile areas etc
- Wildfires can become common and can cause health hazard to people



CLIMATIC-TOPOGRAPHICAL ZONES OF PAKISTAN

Fig2.20

3

WATER RESOURCES OF PAKISTAN



*Irrigation System of Pakistan

*Small Scale Systems
Karez
Shaduf
Noria

*Large Scale System
Dams
Barrages
Canals

*Indus Water Treaty

*Waterlogging and Salinity

*Uses of Water

ACKNOWLEDGEMENTS

Fig3.2 **Samuel Bailey**

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Fig3.3 **Adrián Mallol**

Fig3.4 **Daniyal Gilani**

IRRIGATION SYSTEM OF PAKISTAN

Irrigation is the artificial supply of water to land. Pakistan needs irrigation because:

- **Timing** of rainfall is variable. Variance in timing means that one year most of the rain falls in the beginning few weeks of the rainy season, and next year most of the rain falls in the latter part of the rainy season. Thus the farmer has little idea as to when to plan for irrigation or a separate source of water, if rains are insufficient. Also between two wet seasons (monsoons and western depressions) we have a gap of 2-3 dry months

- **Amount** of rainfall is variable. Variance in amount means that one year we have a lot of rainfall and in the next there are little rains. This means that the farmer won't actually be able to know whether he should plant a water hungry crop like rice or a lesser water hungry crop like cotton etc

- **Distribution** of rainfall is variable. Variance in distribution means that one district receives more rainfall than the other district, but the next year the opposite happens. This means that the farmer won't actually be able to know whether he should plant a water hungry crop like rice or a lesser water hungry crop like cotton etc

- **Intensity** of rainfall is variable. Variance in intensity means that the rainfall either comes in one great downpour or comes in gentle strides. If the rain comes in form of a downpour then it is of little use as the soil will have little time to absorb it, therefore, most of the water won't get into the roots. Also this will cause erosion due to force of running water and can cause floods too.

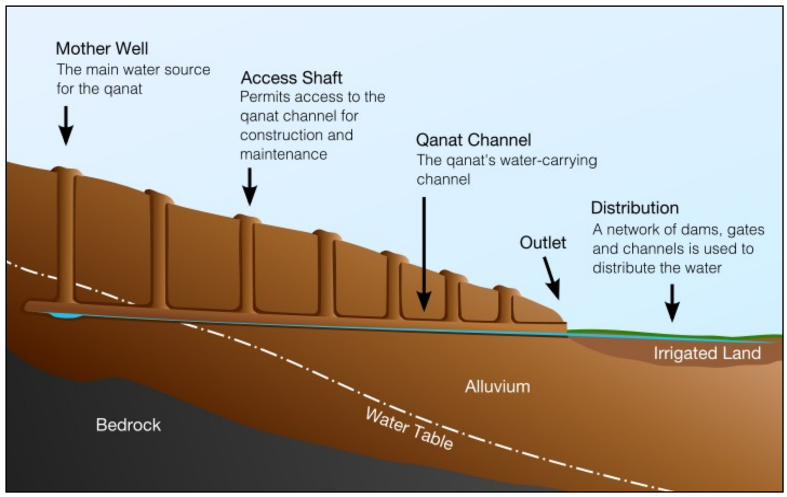
  On the other hand if the rain comes down slowly then it will have more time to infiltrate the soil and will be beneficial

- Also the rate of evapo-transpiration is high due to intense heat, also humidity **generally** decreases as we move from north towards south (except the coastal areas), so plants can lose water quite quickly

Small Scale Systems

- **Karez**

Fig3.1



Karez water system is made up of a horizontal series of vertically dug wells that are then linked by underground water canals to collect water from the water surface runoff from the base of hills or mountable beneath a mountain/hill slope.

The canals channel the water to the surface, taking advantage of the gravity. The canals are mostly underground to reduce water evaporation. Vertical wells are dug at various points to tap into the groundwater flowing down sloping land from the source. These vertical wells are also used for maintenance of Karez

The water that is utilized has collected in the subsoil over many thousands of years and takes a lot of time to replenish so this is a highly unsustainable source. Also Karez can only work in mountainous terrain and not in plain areas. Maintenance work is not so expensive but dangerous due to risk of collapsing tunnel or an unexpected rise in water level etc

They are used in Balochistan by subsistence farmers to grow dates, maize, millets etc

- **Shadoof**

Fig3.2



The shadoof consists of an upright frame on which a long pole is suspended. At the long end of this pole hangs a bucket, while the short end carries a weight (stone) which serves as the counterweight. When correctly balanced, the counterweight will support a half-filled bucket, so some effort is used to pull an empty bucket.

Its use is time consuming and it provides very low amount of water but can be used in both flat and mountainous terrain. It is used by subsistence farmers only

- **Noria**

The most common example consists of a vertical wheel which is slung with a chain of buckets. The buckets hang down into a well which may be up to 26 ft deep. The most primitive norias of this type are driven by donkeys, mules, or oxen. The animal turns another wheel, which is engaged with the Noria and so causes it to turn. This causes the buckets to circulate



Fig3.3

Noria can provide more water than that provided by Shadoof but less than that of Karez. It is used in plain areas by small scale subsistence farmers and is not very difficult to construct

- **Tubewells**

A tubewell consists of a diesel or electric motor that pumps out water through a pipe from the subsoil. The pipe reaches the subsoil water, which is then pulled on to the surface by the motor

These are used by commercial farmers (large scale growers) as they are expensive to buy

and maintain but they do provide large quantities of water

- **Tankers**

They are trucks with a big tank. The tank stores water and has a nozzle through which the water is re-directed. The tank is filled where water is available and then delivered where there is a deficiency of water. These are very rarely used for irrigation purposes

Large Scale System

- **Dams**

Pakistan has two large dams (Tarbela and Mangla), while all other dams are either small or medium sized. Tarbela and Mangla are multipurpose dams which store water not only for irrigation but also for generating power. These dams have reservoirs because the dam wall holds up the water. Spillways are gates through which the water is allowed to go downstream due to either deficiency of water downstream or flooding upstream. A dam may break if it is filled beyond its capacity.

Both Tarbela and Mangla store water during the **main rainy season (monsoons)**, which accompanies the **melting of snow and ice (due to high temperatures in summers)** in the Northern Mountains. The rainwater and melted snow drains into the rivers and ultimately ends at the reservoir. Here water is released in controlled and calculated amounts from these dams during the Kharif and Rabi seasons

Tarbela dam is 9,000 feet long and 486 feet high

- **Barrages**

Barrages are long structures similar to a dam. They divert water that is in the river into the canals. They have many dozens of gates, which either can be closed to create a lake with the embankments of a river serving as a container wall. Pressure builds up as the height of lake increases thus forcing the diversion of water into canals. These canals are dug from sides of reservoirs of barrages

Or the gates of a barrage can be opened and allow water to continue its course in the river. These structures are built only in plain areas as opposed to dams. It is a misconception that barrages cannot generate electricity (they can and do)

Barrages have been built to transfer water between rivers via link canals, like Rasul-Qadirabad Link canal. Sukkur Barrage has 60 gates with total length of 4000 feet

Fig3.4

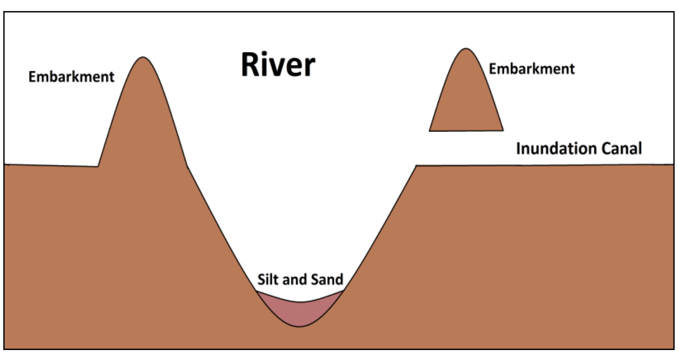


- **Canals**

There are two types of canals, perennial and inundation. Inundation canals are those canals which rely on flood waters in a river to irrigate nearby areas. Perennial canals are those canals which are dug from sides of reservoirs of barrages

Smaller distribution canals take water from these perennial canals and divert it to the fields. Most canals in Pakistan are unlined, which leads to excessive water seepage, thus eventually leading to waterlogging and salinity (explained later)

Fig3.5



ADVANTAGES OF LARGE SCALE IRRIGATION SCHEMES

- They provide large quantities of water, so crops can be grown in even the most barren areas (like southern Punjab, where rainfall is very low etc).
- This has lead to settling of people in these areas and creation of new cities and jobs etc like Faisalabad
- Water supply is not affected by seasonal changes in water table etc, to which shadoof etc are affected. So water from these large scale irrigation schemes is available throughout the year. This is necessary because rainfall can vary in terms of quantity, timing, distribution and intensity
- In Pakistan, the rate of evapotranspiration of water is too high, so an artificial and **steady** supply of water is required
- Less time is taken to irrigate a unit area as compared to like other sources like for example shadoof
- Yields can be increased with use of high yielding varieties of seeds (which require more water)
- Double cropping can be achieved within a single year meaning that two crops can be grown in a year both in wet and dry seasons. Without large scale irrigation schemes, crops could only be grown in the wet season

DISADVANTAGES OF LARGE SCALE IRRIGATION SCHEMES

- Waterlogging and Salinity is caused (explained later in this same chapter)
- They are expensive to build (dam wall, canals, tunnels etc)
- They are expensive to maintain (siltation in reservoirs of dam, cleaning of canals etc)
- Less water is available downstream for mangroves etc. Also it causes seepage of salty seawater in fertile areas of Lower Indus Plain (so crops can no longer be grown there)

INDUS WATER TREATY

After the partition of subcontinent the headworks (*headworks of Madhopur on the Ravi and Ferozpur on the Sutlej were given to India*). Canals from these headworks irrigated a vast area in southern Punjab

On April 1, 1948, India stopped the supply of water to Pakistan. Pakistan protested and India finally agreed on an interim agreement on May 1948. According to this the Pakistani government was to pay for the water it required. The agreement was not a permanent solution. Thus Pakistan approached the World Bank in 1952 to help settle the problem permanently.

Negotiations were carried out between the two countries through the offices of the World Bank. Finally an agreement was signed between India and Pakistan in September 1960. This agreement is known as the Indus Water Treaty.

This divided the use of water between the two countries. Pakistan obtained exclusive rights for the three western rivers, namely Indus, Jhelum and Chenab. India retained rights to the three eastern rivers; Ravi, Beas and Sutlej. The treaty also guaranteed ten years of uninterrupted water supply period during which Pakistan was to build huge dams, financed partly by long-term World Bank loans, UK and USA aid and compensation money from India. Three multipurpose dams; Warsak, Mangla and Tarbela were built. Eight link canals were also built to transfer water from three western rivers into three eastern rivers. Five barrages and a gated siphon were also made



Fig3.6

WATERLOGGING AND SALINITY

Problem

Waterlogging occurs when the rate of infiltration is faster than rate of evaporation of water. Transpiration is the process by which plant roots absorb water and then lose it in form of water vapour through their leaves. Thus, the water table is lowered

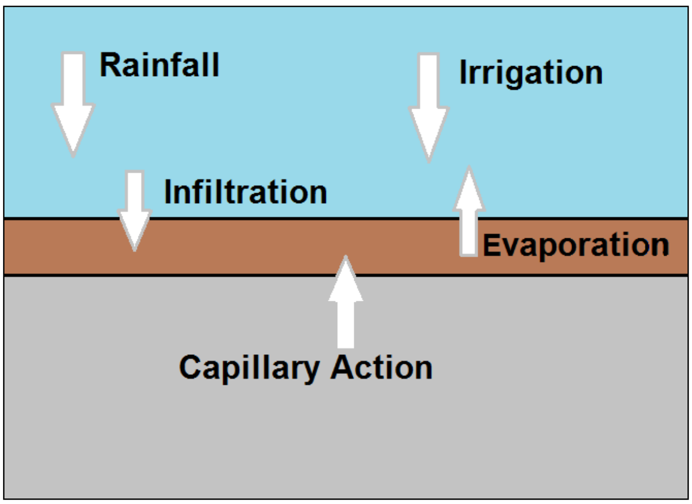


Fig3.7

Infiltration is the seepage of water into the watertable. Waterlogging occurs when the water table rises and comes around 5-10 feet near the surface. Then water along with dissolved salts rises through pores in the soil due to capillary action. As a result of the water accumulation the soil becomes a bit muddy

After this the water evaporates leaving behind a hard white crust of soil, which results in **salinity** (Fig3.8). Plants can't survive these salty conditions as their roots lose too much water to the salty soil. The lost water can't be replaced quickly enough and the plant dies.

This problem has become aggravated after the completion of dams and construction of unlined perennial canals. Due to dams, water is available all throughout the year in the unlined perennial canals leading to seepage of water throughout the whole of the year. Previously, with inundation canals only during rainy seasons did excessive seepage of water occurred.

As a result around 30% of cultivated land in Pakistan has been affected by waterlogging and salinity. Projects like SCARP (**S**alinity **C**ontrol **A**nd land **R**eclamation **P**rojects) have been setup to deal with the problem



Fig3.8

Solution

Waterlogging can be solved by using a tubewell. Firstly, watertable is lowered by using tubewell and draining this water and diverting it to other areas. Once the ground water table has receded, the problem of **waterlogging** has been solved

If the water from the tubewell is fit for irrigation (not too salty), then bunds are built around the fields affected by **salinity**. Then the field is flooded by the water from the tubewell or any other source like canal etc. The water dissolves the salts

and takes them into the watertable, thus the problem of waterlogging and salinity is cured

Prevention is better than cure, so it is better to prevent waterlogging and salinity from occurring in the first place. For that these steps can be taken

- Lining the canals and making sure that they don’t have water in them when it is not required by crop
- Surface or subsurface drains can be built. They have unlined walls but essentially they are lower (deeper in earth) than water-carrying canals. When the watertable rises, the water seeps inside these canals, which then drain into any river or lake etc
- Sprinkler irrigation or better trickle drip irrigation systems can be employed. Traditionally in Pakistan fields are flooded meaning that most of water just drains into the watertable rather than being absorbed by plant roots. Use of trickle drip irrigation can cut water requirements by 60%
- Deep root tree species can be planted like many eucalypts, which decrease water table level

WATER SHORTAGE IN PAKISTAN

Reasons

- Siltation of reservoirs of dams has meant that these dams have reduced capacity. Thus more of the flood water is allowed to go downstream and thus less is available for future use
- Siltation of rivers and canals has meant that these have limited carrying capacity, thus less water now reaches the tail-end crops (that are at the farthest end of a canal)
- Global Warming has resulted in reduced rainfall in some areas like the catchment areas of River Chenab, the river flow has dramatically reduced in past 20 years
- Furthermore Global Warming has resulted in accelerated rate of evapo-transpiration, so crops now require more water
- Most of the canals in Pakistan are unlined, so that water can seep out from them into the water table throughout the year almost
- To meet the demands of a growing population more crops (Wheat, Sugarcane etc) have been grown after 1970. However, no new significant source of irrigation water has been implemented
- The usage of water by industry has also increased due to the increased industrialization
- Due to industrial pollution less and less water is suitable for human consumption. As a result deeper and deeper aquifers of water are being utilized, which originally take hundreds of years to accumulate. Their rate of consumption is higher than the rate at which they can replenish themselves

Solutions

- Drip irrigation can be used to irrigate the crops which can cut water usage by 1/3

Fig3.9



- Re-afforestation and Afforestation projects in Northern Areas must be implemented to reduce erosion as erosion leads to siltation.
- Also, canals must be cleaned to remove the accumulated dirt. They must also be lined to **reduce** water seepage (cannot prevent it totally)
- New varieties of crops must be used that produce good yields while consuming less water
- Industrial waste and sewage must be treated so it is fit enough to be drained into river (so it could be used by crops etc)

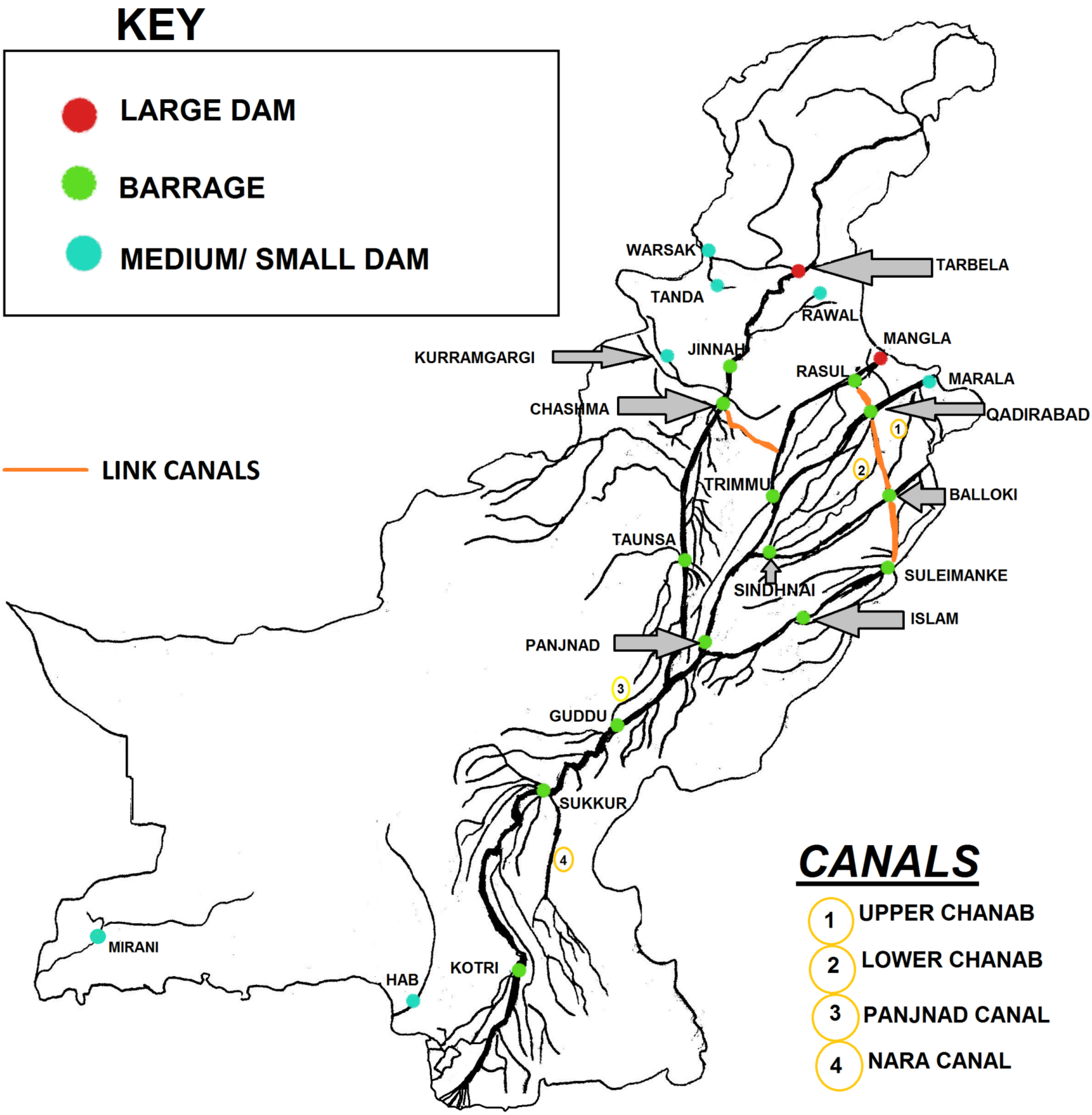
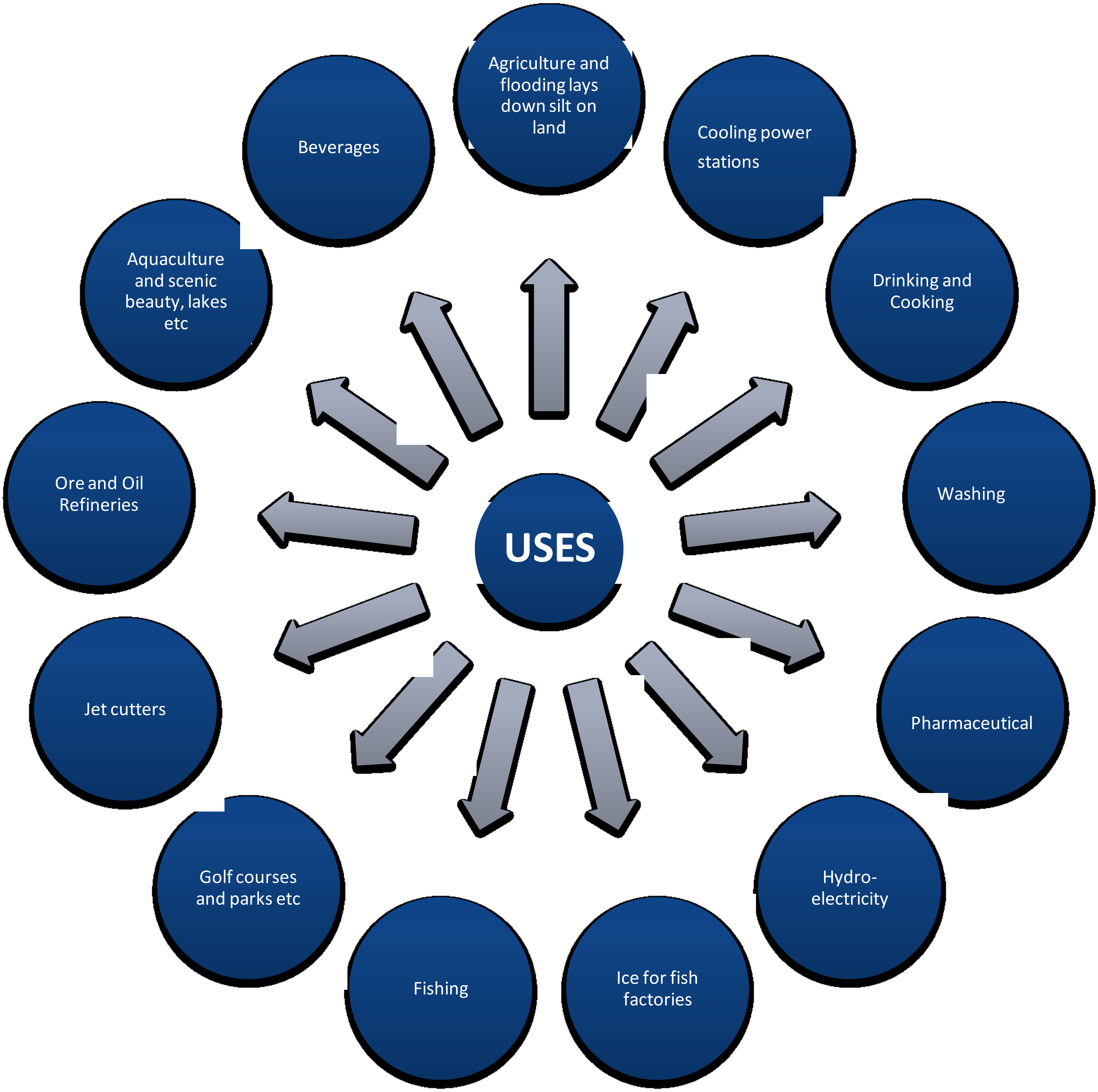


Fig3.10

Here the main irrigation network of Pakistan is shown including MAIN canals, link canals, small/medium dams and large dams

- **Chashma-Jhelum link canal** transfers water from Chashma barrage on River Indus to River Jhelum

- **Rasul-Qadirabad link canal** transfers water from Rasul barrage (Jhelum) to Qadirabad barrage (Chenab)
- **Qadirabad-Balloki link canal** transfers water from Qadirabad barrage (Chenab) to Balloki barrage (Ravi)
- **Balloki-Suleimanki link canal** transfers water from Balloki barrage (Ravi) to Suleimanki barrage (Sutlej)


USES
Agriculture and flooding lays down silt on land
Cooling power stations
Drinking and Cooking
Washing
Pharmaceutical
Hydro-electricity
Ice for fish factories
Fishing
Golf courses and parks etc
Jet cutters
Ore and Oil Refineries
Aquaculture and scenic beauty, lakes etc
Beverages

FORESTS IN PAKISTAN

4

Fig3.11



*Distribution of Forests in Pakistan

*Types of Forests in Pakistan
Productive and Protection

*Species of Forests
Alpines, Conifers, Mangrove, Scrub, Irrigated, Thorn and Bela

*Causes of Deforestation

*Effects of Deforestation

*Reducing Effects of Deforestation

*Importance of Forests

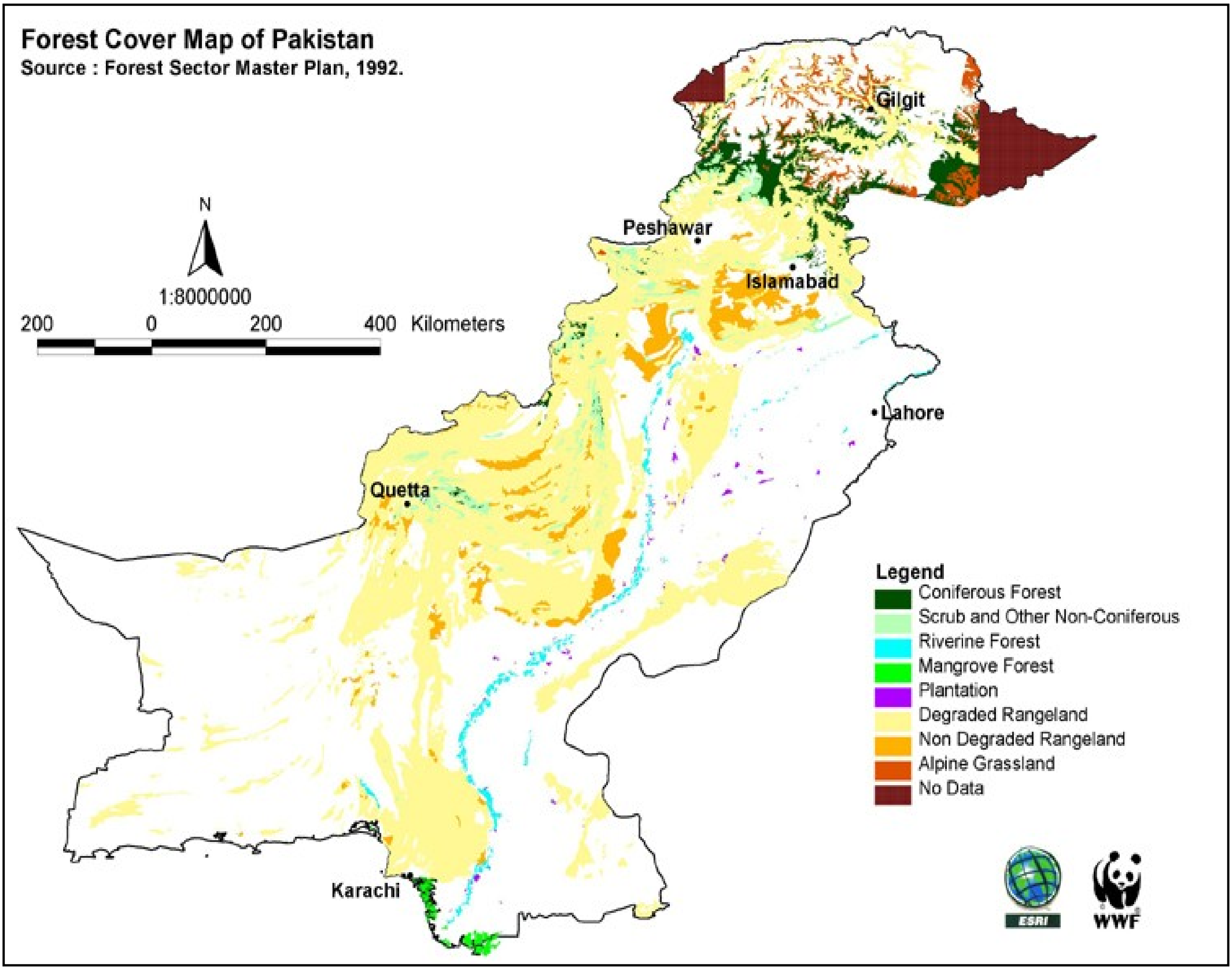
*Factors affecting forest distribution

ACKNOWLEDGEMENTS

Fig4.1	**Pakistan Wetlands Programme (PWP), WWF-Pakistan and Forest Sector Master Plan (FSMP)** © All photos, graphics and images on this site remain the property of the Pakistan Wetlands Programme but may be used for non-commercial conservation purposes provided that their source is properly acknowledged.
Fig4.2	**Rob Chandhok**
Fig4.3, Fig4.6 and Fig 4.7	**Sarfraz Hayat**
Fig 4.5	**Hasan Mubarik**
Fig4.8	**Dana Chisnell**

Forests are extremely vital for the development of Pakistan

Fig4.1



Types of Forests

Productive

- These are natural forests
- They **usually** have a closed canopy, which blocks out the light reaching the forest floor. So, the forest floor has little vegetation
- These forests have high tree density and trees are highly valued due to their timber

Protection

- These forests are planted by man
- These forests are evenly spaced out and usually the forest floor also has some vegetation
- Tree density is not very high
- They don't have much commercial value and are instead planted to control soil erosion, provide shade and lower the temperature

Species

Alpines (Birch)

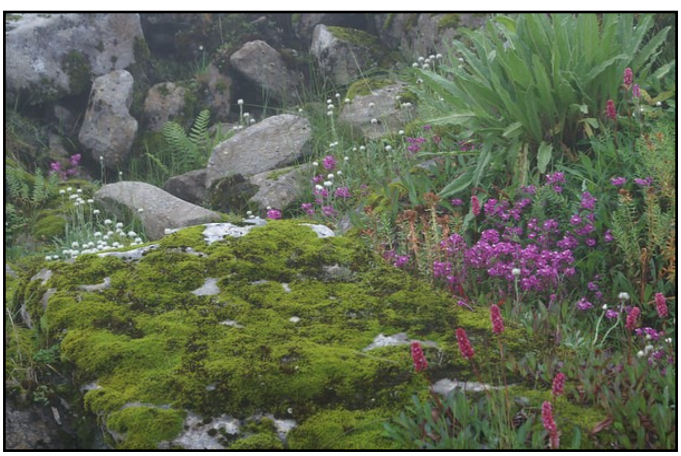


Fig4.2

- They grow from treeline (4000m) to snow line (4500m). At treeline, trees don't grow and at snowline the ice doesn't melt all year around (snow doesn't melt even in the summers)
- These are dwarf forests due to severe climatic conditions like lack of **liquid** water and very short growing seasons in summers
- They have low height to avoid cold winds which have less speed near the surface
- These forests have upward branches to attain more sunlight
- They grow between rocks to shelter them from cold winds, which would freeze the sap in their thin stems
- They are evergreen
- The tree density is low as nutrients are already in the soil and more trees in a small space might result in critical deficiency of these in the soil
- They are found in districts of Astore, Gojal, Skardu and parts of Ghizar
- They are mostly used for firewood

Conifers (Fir, Spruce)



Fig4.3

- They grow from 1000m to 4000m. These are the **most abundant type of forests found in Northern Pakistan**
- Most conifers are evergreen; they do not shed their leaves because of short growing season (summers)
- They have long, thin and needle shaped leaves with waxy cuticle, so to minimize water loss by evapotranspiration
- They have straight high trunks to reach more sunlight in valleys to avoid shadows
- Their seeds are stored in cones and can stay dormant for years until favourable conditions for germination arise
- Cones protect them from forest fires and also cold weather
- They have thick bark to protect from cold weather
- They also have a flexible trunk to prevent the tree from snapping. The trunk is compact and conical in shape which helps stabilize the tree in strong winds
- Their springy branches bend down so accumulated snow can slide down rather than break the branch due to its weight
- They have shallow and wide spreading roots to search for scarce nutrients, avoid permafrost soil and to anchor the tree in the ground
- The forest floor has low amounts of vegetation due to blockage of sunlight by tall conifer trees
- They are mainly used for timber and for extracting paper
- They are found in districts of Swat, Shangla, Abbotabad, Nowshera, Gilgit, Skardu

Mangroves

- Mangroves have prop roots so they can absorb more oxygen through the pores in their bark. This is because **most** of the roots are submerged in water. The roots which are exposed to water can absorb oxygen
- They have highly impermeable roots, which limit the amount of salt entering the plant
- The salt which eventually enters the plant is stored in old leaves when they are to shed away
- They have thick leathery leaves which can control the size of their pores (stomata), effectively limiting the amount of water the plant transpires
- They are used for timber, fuel wood, leaves for camel fodder, branches for roofs along with mud, and for extraction of honey
- They also reduce soil erosion in coastal areas due to tidal action, thus they extend time for

ports after which dredging is required to make them deep again

- They form important breeding and protection grounds for fish
- They reduce the impact of tsunami and tropical cyclones by acting as barriers to their brute force
- They are found in Indus delta (Karachi and Thatta districts) and Hab delta (Gwadar district)

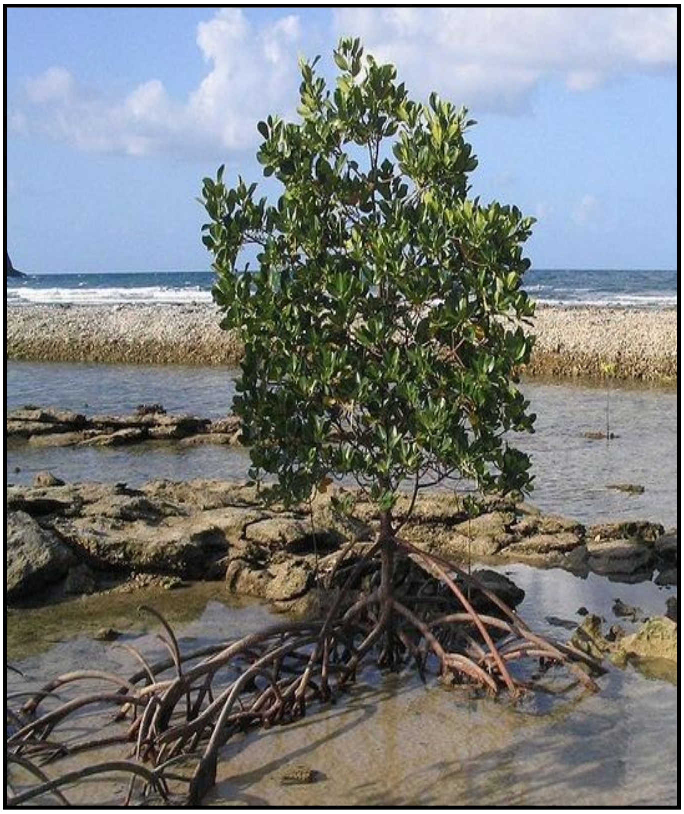


Fig4.4

Subtropical (Scrub forests) part of Rangeland

- These forests contain a mixture of trees, dry grass and shrubs
- Trees are round in shape with thick trunks to reduce water loss. They have broad leaves for more photosynthesis
- Trees also have deep roots to search for water and they shed their leaves in dry period (deciduous)to conserve water loss through transpiration
- Trees are used for timber, firewood and grazing by animals
- Shrubs are small, rounded and thorny (to conserve water). They also have deep roots to search for groundwater

Irrigated Plantations



Fig4.5

- Commercially valuable species like Shishum and Babul are planted (like in Changa Manga near Lahore)
- Trees are planted **at once** in blocks with **one type** of tree in **one block**. Same time of plantation means they can also be easily harvested at once
- Trees are planted equidistant to each other in a straight line
- Between the blocks roads run in rectangular pattern. They are used to transport lumber and machinery
- Also, water courses run between the blocks. The level of water in the courses is lower than the trees, so to prevent waterlogging in the root area
- They are found at Changa Manga near Lahore, and at Chicha Watni etc
- They are used for making matchsticks, furniture, agricultural instruments (plough, gates) and reducing air pollution etc
- Some trees are also used for pulp production which makes paper and some are used for chemicals like varnishes or medicines etc
- Some are used for making sports goods like bats or to make crafts like wooden toys etc. Others may be used as railway sleepers **but not as rail engine fuel** (sleepers are planks which are laid beneath the track)
- They provide employment to the people working in the forest department

Linear Plantations

- They are planted by man
- These are plantations alongside roads, parks, railways, motorway etc
- They are planted in a straight line and are equidistant
- They usually have one type of tree in a line
- They don't have much commercial value and are instead planted to control soil erosion, provide shade, control air pollution and lower the temperature. They may also be used for firewood

Thorn forests also part of Rangeland

- Trees are low in height 6-10 feet
- As name suggests they have lot of thorns to prevent grazing
- They have a deep tap root system to search for water
- Their small leaves prevent water loss.
- Umbrella shaped tops enables the leaves to catch as much sunlight as possible



Fig4.6

Riverine/ Bela Forests

- These forests are a mixture of small shrubs and grasses along with trees
- Tree height varies from 2 -18 metres. Most trees have strong trunks to withstand flood water
- They can tolerate arid conditions along with high temperatures
- Some species can also tolerate high salt concentration in water
- Most species are evergreen but not all
- They grow along banks of Indus in straight lines
- They are found mainly in Sindh along Indus, some are also found in Indus in Punjab, while others are found near banks of Jhelum and Chenab

Causes of Deforestation

- Growing population means more land is required for housing, so forests are cleared.
- Demand for forest based products like timber for furniture, ploughs, making beads and rackets , ephedra, paper from pulp etc has increased. Forests are cut down to fulfil the demand of these products
- Wood is also used to make agricultural implements
- To provide room for growing more crops to fulfil demand and also for grazing animals (cattle ranch)
- Construction of roads, railways and airports also clears forests
- Storage of water in reservoirs of dams floods the area. This has **decreased** the amount of fresh water and alluvium reaching the Bela and Mangrove forests downstream, which is vital for their existence
- Before open cast mining starts an area is cleared of its vegetation
- Farmers tend to clear a patch of land and to use it for growing crops. Such practices tend to lead to rapid soil degradation as most soils are too poor to sustain intensive crop growth. So, the farmer is eventually forced to clear another patch of forest after a few years (Over-Cultivation)
- Overgrazing by cattle and goats reduce the chance of land regaining its vegetation
- In Northern areas which have no gas supplies for cooking and heating; wood is used
- Wildfires also cause a lot of damage to forests along with corrosive acid rains formed due to polluting industries
- Corruption amongst forest officials, who allow illegal cutting
- Industrial waste and effluent discharge in the Indus Delta has caused stunted growth of Mangroves
- Dry climate of regions like Balochistan mean that these areas have little forest cover to bind the soil together. Also this dry fertile soil is light and easily eroded by strong winds
- When forests are cut, there is less infiltration of rainwater into the soil (less is absorbed by the roots), less rainfall occurs as there is less transpiration by the plant leaves and there is less humus formation (humus is formed due to decomposition of dead leaves). All of this means that plant growth becomes even more unfavourable in the future

Effects of Deforestation

- The most vivid effect of deforestation is on the soil usage. The roots of trees used to bind the particles of soil together but now during heavy rainfall, massive soil erosion occurs along with landslides
- This loss of soil may result in removal of top few inches of soil over period of some years. These top inches have the most fertile soil of any layers, and the layer left behind is deficient in nutrients thus it may not support much plant life and area becomes barren
- Landslides block roads, railways and disrupt communication and supplies mostly to Northern areas of Pakistan. Power lines may be washed away by landslides and floods
- The eroded soil settles in the reservoirs of dams and barrages, and reduces HEP production along with reducing storage capacity, it also damages power lines
- Cheap electricity via HEP helps the economy but now it becomes scarcer
- Less storage capacity means that less water is available for Rabi and Kharif crops resulting in low yields
- We would need to import food and would not be able to effectively export our agro-based products like rice on competitive prices. This is because low production will result in low surpluses. Thus the government may put a heavy tax on export
- Patterns of rainfall may also change leading to drought conditions as trees absorb ground water and transpire it into the air
- Cutting of trees may also affect tourist destinations leading to loss of tourists as the case with Murree
- During rainfall first leaves get wet, then bark and then finally the forest floor. This slow process (interception) means that the land has more time to absorb water, so more water can be absorbed otherwise flash floods may occur, which destroy agriculture and economy alike as government needs to divert funds from developmental projects (education, healthcare) to rehabilitation
- Burning of forests results in addition of Carbon Dioxide into the air and also results in low absorption of this greenhouse gas. This contributes to Global Warming, which in turn will lead to melting of glaciers and consequent flooding of coastal areas like Karachi

Reducing Affects of Deforestation

- Terraces prevent erosion by shortening the long slope into a series of shorter, more level steps. This allows heavy rains to soak into the soil rather than run off down the slope and cause erosion



Fig4.7

- Contour ploughing can be practised. In contour ploughing, the ruts made by the plough run perpendicular rather than parallel to slopes, generally resulting in furrows, which checks the speed of water runoff and eventually reduces soil erosion
- Selective logging that is cutting of only mature hardwoods should be enforced and use of heavy machinery must be limited as it does tremendous damage to even immature trees which aren't going to be cut
- Small check dams can be built on small rivers and streams to reduce erosion and gullying; by allowing sediments to settle down
- High yielding varieties of crops can be used which give more yield per unit area and are resistant to pests etc so less forests are cleared for growing crops
- Regions which have large forest cover must be declared national parks, where logging and hunting is prohibited by law
- Gas can be provided to Northern areas so less forests are cut for firewood
- People of Northern areas must be better educated about importance of forests. They could be better trained in management of forest resources
- Shelterbelts can be planted. These are usually made up of one or more rows of trees planted in such a manner as to provide shelter from the wind and to protect soil from erosion. They are commonly planted around the edges of fields on farms



Fig4.8

- Afforestation and re-afforestation schemes can be started
- Strip farming can be practiced in which alternate strips of cotton, wheat and corn crops are planted. This forms a formidable barrier against wind erosion

Importance of Forests to Pakistan

- Roots help to prevent soil erosion; if this does happen then the soil can be eroded by wind and then taken to lakes and rivers. Thus rivers can become muddy whose water would become unsuitable for drinking
- Area under forests must be increased so as to reduce imports of timber. This will saves us precious foreign exchange
- To retain beauty of tourist sites like Murree etc, where a lot of local earning is dependent upon tourism
- To relieve waterlogging and salinity as some trees lower the water table as their roots absorb a lot of water
- Mangroves prevent erosion in Indus delta as they reduce the impacts of tidal waves by serving as a barrier. Less erosion means less deposition occurs at ports of Bin Qasim and port of Karachi, which need not to be re-dredged for a longer period of time. This saves huge sums of money.
- Mangroves also form important breeding and protection grounds for fish

Factors affecting forest distribution

- Height of the land; conifers only found from 1000m to treeline (4000m)
- Temperature is also crucial. Mangroves only grow where temperature varies from 25°C to 35°C. Also sunshine must be present throughout the year
- Water requirement is also an important factor as Bela forests can't grow in dry regions like Thar desert without irrigation
- Also the fertility of land is crucial. Alpines can survive in poor soils but Mangroves and Bela forests can be seriously affected by growth in poor soils

SUSTAINABLE FORESTRY

Sustainable forestry means that forestry is done in such a way that present demands can be met, while not compromising on the ability of future generations to derive their demand from the resources they will have.

So forest management becomes very important, where only a few hardwood species are cut down every year. For every tree cut, 5 trees are re-planted, to make sure that damage is catered for well.

These trees take a lot of time to grow back (long term investment) and thus the pay-off comes late. It costs a lot to sow the plant, water it and maintain forests while keeping illegal loggers out of the area (looking after the forests)

FISHING IN PAKISTAN

5



*Methods of Marine Fising

*Distribution of Catch

*Improvements along Makran Coast and in general

*Inland Fishing
Subsistence and Commercial

*Growth of fish farming

*Uses and importance of fish caught

*Problems of fishing industry and it's sustainability

ACKNOWLEDGEMENTS

Fig5.3	**Rizwan Qureshi**
Fig5.4	**Jose Puissant**
Fig 5.5	**Bilal Mirza**
Fig5.6	**Khalid Memon**

Fishing is a primary sector industry. It is the main occupation of people living in the coastal areas of Pakistan; serving as their main source of food and cash as the surplus catch is sold.

There are two types of fishing. One is marine fishing that is carried out on the coasts of Sindh and Balochistan. While the other is inland fishing that is carried out in reservoirs of dams and barrages, lakes and rivers along with fish farms.

Methods of Marine Fishing

Types of catch caught varies from prawns, crabs, lobsters are caught in Indus Delta. Herring, Mackerel are caught in Hab delta (simply along Eastern coast of Balochistan). Sardines and shark are caught along both coasts

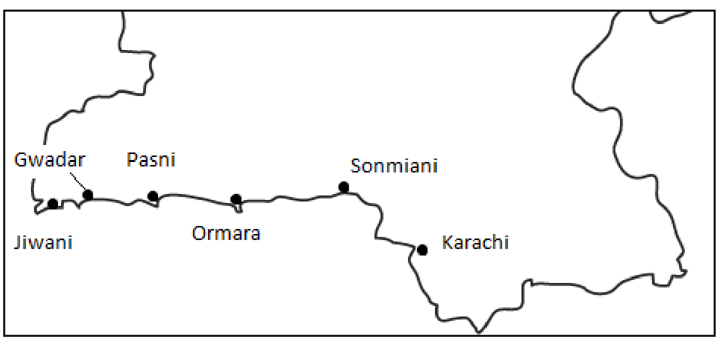


Fig5.1

Subsistence

- It is carried out by illiterate and poor people living in coastal villages
- A fisherman has a wooden sail boat which can only go for 5-10 km away from the coast. Since his boat uses land and sea breezes for locomotion, he can only go for fishing in morning and come back in afternoon.
- The subsistence fisherman may also use a wooden row boat or a wooden boat fitted with a small engine
- Since the distance travelled by these boats is small, the fisherman can only exploit the fish near the continental shelf but not that is in deep sea. Thus fish stocks in continental shelf are over-exploited

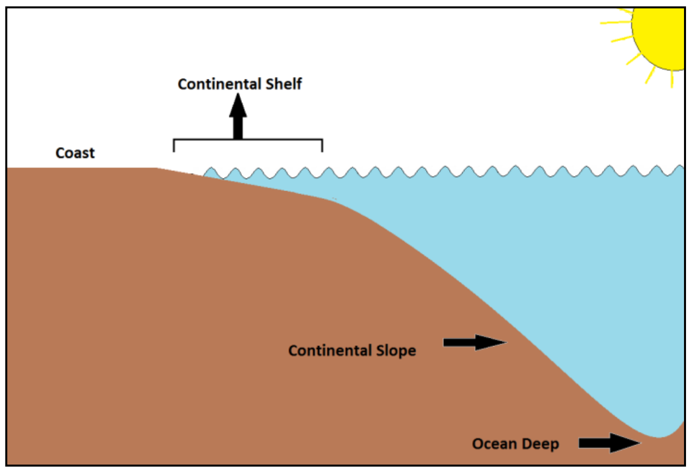


Fig5.2

- The fisherman has a traditional small net so his catch is small.
- During the monsoon season the sea is rough so he can't go out, thus the fisherman must find some alternative work
- The fisherman takes ice with him in a small bucket to store his limited catch
- The whole family is involved; male catches the fish whole the rest of the family cleans off the scales and removes the gut of fish



Fig5.3 Subsistence fishing as wooden boat is used



Fig5.4

Commercial

- It is practiced by fishing companies mostly along the developed Sindh coastline. It involves fish caught in bulk, thus it is a permanent source of income
- Motorized boats are used which can travel 40-50 km off coast and into the deep water to catch the unexploited stocks of fish
- These boats also have refrigeration facilities so fishing can be done uninterruptedly for 10-15 days.
- Ice is bought in large quantities from ice factories along both coasts and loaded onto the fishing vessels
- Gill netters help in quickly catching large amount of fish (fig5.4)
- Sonar is also used to locate shoals of fish so more fish can be caught in less time. This saves operating costs
- Weather forecasts are used for safe navigation and for returning catch without sinking
- GPS helps in quickly locating fish/crab **pots**

Distribution of catch

Most of catch is along Sindh coastline it is because of following reasons

- Large population of Karachi offers a bigger market for the fish catch. Catching fish near the demand source lowers the transport cost of fish for the fishermen
- Most fishing companies operate near Karachi as it is more developed than other coastal areas of Pakistan
- Indus Delta in Sindh is much larger than Hab delta in Balochistan. Indus delta has a much bigger river, which brings in more silt for Mangroves. Mangrove roots provide protection and breeding ground for fishes.

- Also the leaves of these trees degenerate to form food for fish
- Sindh has a much shallower coast farther off-shore than Balochistan's coast. Shallower coast means more sunlight can penetrate the sea and more plankton (main food of fish) can photosynthesize. So fish are abundant near Sindh coastline
- Korangi fish harbour is more developed than fish harbours on the Balochistan coast. The Korangi one has more docking space. It also provides storing, processing and export facilities
- When the catch is processed value is added to it. For example by removing scales and guts of fish and canning it, it fetches more money than the unprocessed fish would have fetched
- Ice required for commercial fishing is available at Korangi. The ice prevents the catch from getting spoiled too quickly
- Fish guts and scales that could have been wasted are crushed to make animal feed due to presence of fish related industries. This means that a fisherman earns more for the fish than he would have earnt if he had disposed off the guts etc

IMPROVEMENTS ALONG MAKRAN COAST AND IN GENERAL



Fig5.5

- Completion of Makran coastal highway (Fig 1). It has allowed for the transport of catch from less populous Makran coast to the Sindh coast where there is higher demand.
- The highway also has allowed the transportation of machinery to Makran coast to develop fishing industry there like ice factories etc
- More ice factories have been constructed there to promote commercial fishing by providing the pre-requisites for commercial fishing
- A fish harbour has been constructed at Gwadar and export facilities are being developed for fish related products
- Electricity has been brought in from Iran to run ice factories at Gwadar, ice along with salt helps in preserving of fish, thus reducing post harvest losses to fishermen. For example a fisherman at coast catches 10 kg of fish, but due to poor preservation methods, only 8kg

of his catch is seemed as fit for consumption and he thus doesn't receives any money for the 2kg lost

- EU inspectors have inspected fish processing facilities along Makran Coast and have found conditions to be improving in terms of hygiene with sorting tables for crabs and shrimps
- But even still majority of catch is from subsistence fishing. The government is giving cheap loans to fishermen so they could buy bigger nets and motorize their boats

Inland Fishing

Fish types caught are Hilla, Mahseer, Palla and Trout

Subsistence

- Fishing is practiced in rivers, lakes, reservoirs of dams (like Tarbela) as an extra source of income. In Northern Areas it is done for sports by catching trout.
- Small traditional nets are used to catch the fish

Commercial fishing (Fish farms)



Fig5.6

- Rectangular ponds are dug into the ground (in a regular pattern), which makes it easy to corner and catch the fish ultimately. The ground must be flat for maintaining water level, soft for digging and must have an impermeable soil layer to reduce water loss.
- Different ponds contain different types of fish, which may otherwise harm each other and numerous ponds help in containing diseases
- Embankments are made of soil dug out and trees are planted to provide shade, reduce soil erosion and their leaves degenerate to form food for fish
- The sides of pond are lined with stones or cement to reduce water loss

- Cow dung or fertilizer is spread on surface as food for micro-organism which are eaten by fish
- The pond is half filled with water and after a week or two lime is thrown into it to make it transparent
- Then it is completely filled, and fish brought from hatcheries are introduced
- They are given vaccination and some other food
- When they reach a certain size they are caught and sold
- Paved roads are made between fish farms for transport purposes

Growth of Fish Farming

- Government has provided loans to farmers so they could build and maintain the ponds. These fish farms provide employment and fish exports, which helps to raise the foreign exchange
- The demand for fish has increased due to growing population and increasing public awareness about eating fish with its healthier meat
- Fish farming combined with poultry (whose waste forms excellent fertilizer for plants in pond) gives much higher profit
- In the plains of Punjab and Sindh, these farms are easy to dig and the water level is easy to maintain due to flat land. Machinery can also be used to dig the farm as it is soft with less hard surfaces. High water table and network of canals provide easy access to water, which fills the ponds
- As compared to marine fishing, more people are required in inland fishing; for growing fish (hatcheries) and feeding, maintaining ponds and ultimately catching the fish and transporting it

Uses and Importance of Fish Caught

- The fish is gutted (stomach and intestines are removed etc), after which it is canned or salted or frozen and transported
- Later on it may be made into other products like finger fish etc
- Fish guts, eyes and scales are used to make fertilizer and animal feed
- Fish is sold to earn cash, the sale price is increasing due to ever increasing demand from a growing population
- Shrimps are exported to USA etc and some fish is dried and then salted for export to Middle East and Sri Lanka
- Fish meat is better than red meat as it has Omega 3 so it is better for heart patients. With increasing awareness about benefits of eating fish, the demand for white meat is increasing steadily
- Fish catching also may serve as a tourist attraction in Northern Areas of Pakistan
- Importantly increasing trends of eating fish would put less pressure on demand of cereal crops like wheat. It will result in less land being cleared (to feed a growing population) for growing crops and thus decrease rate of deforestation
- It also provides employment to many people either directly or indirectly and makes use of local resources like cheap abundant pool of labour. Capital (setup) costs are low and returns are quick

Problems for Fishing Industry

- Main problem facing the fishing sector is the lack of funds or mismanagement in development. The longest coast (Makran) is least developed where obsolete methods of catching fish are still being used
- Most areas along the Makran Coast have no electricity, so it is impossible to build ice factories
- Low level of education of fishermen means that only a small number of them can be trained to operate big fishing boats or work in processing factories (which would improve fish production)
- Telecommunication facilities are still poor, thus there is a communication gap between fishermen and buyers (buying and selling). Thus some of the catch may not be in the most ideal condition when it reaches the market and may not sell
- Overfishing is also another problem. After building of Tarbela and Mangla dams, much of the farming area in the Indus Delta was lost due to the intrusion of sea water (as there was less river water to push back the sea water). These jobless people started fishing in an already overcrowded environment. This resulted in decreasing fish stocks
- These dams also resulted in fewer amounts of fresh water and silt for Mangroves. Hab dam also has had an effect on mangroves on Makran Coast
- By-catch also occurs in commercial fishing. Fish not required by the operators is accidentally caught but along with other economical fish it is also killed. This disturbs the balanced marine ecosystem
- Much of Pakistan's fish products like canned fish are banned in EU due to the unhygienic conditions in which they are processed. The other low value added goods like salted fish are exported to Sri Lanka
- This all results in very low investment in this neglected sector of economy, with Gwadar port having only 2 ice factories
- Supplies of potable water to Karachi harbour are limited

Sustainable Fishing

- Fishing of endangered species of fish must be banned to allow stocks to recover
- Nets with certain size of holes be used to avoid by catch of smaller fish, also it allows immature fish to escape so they can breed in the future and allow for recovery of the fish stocks
- Fishing should be banned during the breeding season of the fish, so stocks can recover
- Illegal fishing must be stopped as the illegal fishermen do not conform to rules and regulations. For example they catch smaller and immature fish to maximize their profits, at the expense of future Stocks
- Quotas must be set for countries in international water
- Strict patrols must be carried out on the edges of Pakistan's waters, where foreign trawlers illegally can easily fish, without port charges/license/taxes etc

MINERALS OF PAKISTAN

6



*Minerals and their uses
Deposits, Quality and Future Prospects

*Discovery and Extraction (Coal, Oil and Gas)

*Factors affecting mineral production

*Pakistan's Mineral Imports

*Coal, Gas and Oil of Pakistan

*Distribution of Oil and Gas pipelines

ACKNOWLEDGEMENTS

Fig6.5 Reinhard Jahn

USES OF MINERALS

GYPSUM

- Gypsum Board primarily used as a finish for walls and ceilings
- Plaster ingredient
- Fertilizer and soil conditioner
- Plaster of Paris (surgical splints; casting moulds; modelling)
- Adding hardness to water used for home brewing
- A component of Portland cement used to prevent flash setting of concrete.
- Soil/water potential monitoring (soil moisture tension)
- In foot creams, shampoos and many other hair products

LIMESTONE

- The manufacture of quicklime (calcium oxide) and slaked lime (calcium hydroxide)
- Cement and mortar
- Pulverized limestone is used as a soil conditioner to neutralize acidic soil conditions
- Crushed for use as aggregate—the solid base for many roads
- As a reagent in flue gas desulfurization (sulphur dioxide air pollution control)
- Glass making, in some circumstances
- Added to paper, plastics, paint, tiles
- Toothpaste
- Re-mineralizing and increasing the alkalinity of purified water to prevent pipe corrosion and to return essential nutrients
- Used in blast furnaces to extract iron from its ore
- Medicines
- Cosmetics

ROCKSALT

- Cooking
- Spreading on icy roads to improve traction
- Manufacturing pulp and paper
- Setting dyes in textiles and fabric
- Producing soaps, detergents, and other bath products
- Major source of industrial chlorine and sodium hydroxide
- To preserve fish after it has been caught

Name	Deposits	Quality	Extraction	Future Prospects
Aluminium (Metallic)	74 million tonnes	Low to medium	2,000 tonnes +	Metal will be available for export along with domestic use in automobiles etc Will lead to development of local metallurgy and provide employment
Iron Ore (Metallic)	900 million tonnes	Low to high	24,000 tonnes	Future export seems unlikely due to little exploitation and low supply, but if exploited cheap iron will be provided for local iron and

				steel industry, and for construction etc Thus the import bill will be reduced
Copper (Metallic)	1900 million tonnes	Low to high	15,000 tonnes +	Export is likely if future investment is carried out, thus earning foreign exchange and providing cheap copper for local electrical cables and other copper related industries
Chromite (Metallic)	2.53 million tonnes	Low to medium	27,000 tonnes	Good opportunity to develop known deposits and discovering new deposits. Will save import bill and help in making stainless steel and ferroalloys cheaper if ferrochrome industry is developed through investment
Gold (Metallic)	11.2 (million ounces)	Low grade	-	Chagai District can become an important gold producer of the world specially the Saindak and Reko Diq mines in Balochistan. Reqo Diq is the biggest untapped gold mine in the world. Most of the production will be exported and will save Pakistan a lot of foreign exchange by reducing gold imports
Limestone (Non-Metallic)	Large	High grade	8,697,573 tonnes	Raw limestone not exportable but cement clinker can be exported.

Gypsum (Non-Metallic)	4,850 million tonnes	Medium to high grade	384,513 tonnes	Additional reserves are likely to be found but their export is unlikely.
Rock salt (Non-Metallic)	600m tonnes +	High grade	1m tonnes	
Coal (Non-Metallic)	185,000 million tonnes	Low to medium grad	3m tonnes	Due to poor quality, low exploitation and high local demand export seems impossible. If coal quality upgrading plants are setup, then the ash and sulphur may be removed from the coal, thus increasing local usage. Coal found in Pakistan is very polluting
Oil (Non-Metallic)	300 million barrels	Good Quality	23 million barrels	Additional reserves could be found but export is impossible due to small reserves
Gas (Non-Metallic)	27 trillion cubic feet	Good Quality	900,000 (Million CFT)	Additional reserves could be found and export is also possible but requires future investment and stability in regions of gas-rich Balochistan

SOURCE

http://investinpakistan.pk/pdf/mineral%20sector.pdf

According to Tethyan Copper Company (http://www.tethyan.com/TheRekoDiqProject/RekoDiqResource.aspx), **"the total economically mineable portion of the Rekodiq deposit has been calculated at 2.2 billion tons, with an average copper grade of 0.53% and gold grade of 0.30 g/ton".**

So, the total minable copper deposit is almost 1.2 billion tons. Copper trades at $800/tonne, thus the value of this copper mine alone would be (800*1200000000) = $960 billion. Adding the value of other copper mines, the figures amounts to (800*1800000000) = $1.44trillion or $1440 billion.

Similarly the price of gold per gram is $52, so the worth of gold in this mine is (52*0.3*1200000000) = $19 billion.

DISCOVERY, EXPLORATION AND DRILLING OF OIL AND GAS

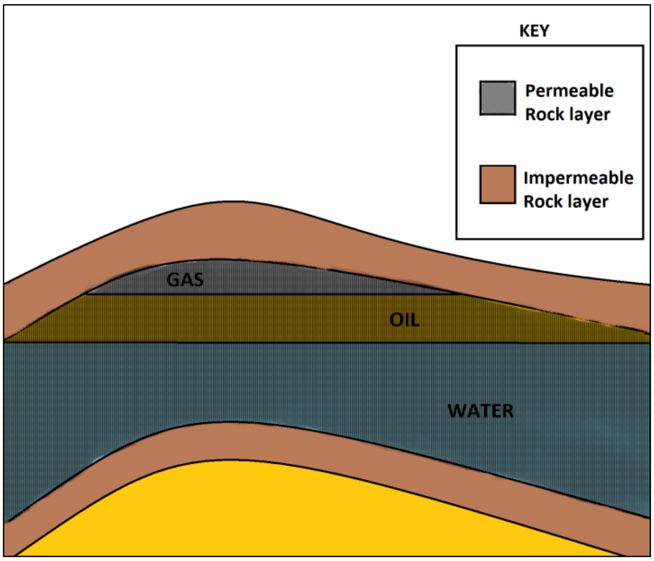


Fig6.1



Fig6.2

Firstly, the geo-physicists look for certain topographical characteristic of seabed or land. They look for an anticline trap. Once they believe they have found an anticline trap, they send a series of sound waves through the soil, which are bent and reflected by the different layers of rock below

The refracted and reflected waves or echoes are collected by special microphones on surface and data is collected and fed into powerful computers, which analyze it and build up an image of rock layers

Once the scientists agree on a potential field they bring in a derrick (Fig 6.2) (used on land) or a drilling rig on sea

The derrick has diamond cutters which drill down the rock layers. Also pipes are lowered.

Mud and water is sent down and retrieved, to remove rock which has been cut and also to cool the drilling rig

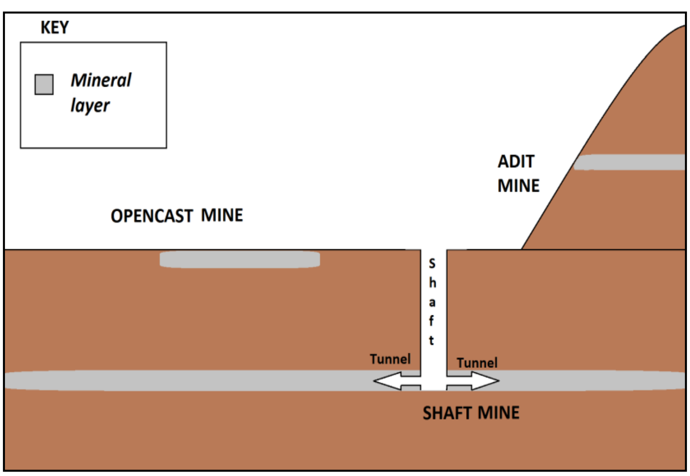
Once they reach a certain depth at which they believe they would find the oil, they retrieve the cutters and send other equipment, which sends sound wave through the rock and also receives the echo

This information is again fed into computers and also analyzed, after which the geo-physicist will decide if the prospect of finding any hydrocarbon is feasible

If it is feasible then drilling will resume and once the hydrocarbon field has been reached, gas at high pressure starts coming at from the well. A cap with a pressure sensor and regulator is installed and connected with a pipeline to transport gas. After the gas has been exhausted oil flows out and is sent to a processing plant

EXTRACTION OF COAL AND OTHER MINERALS

Fig6.3



The extraction of coal occurs by **3 main** methods, which are **Adit, Shaft** and **Opencast**

- **Adit** method of mining is used when a mineral layer is exposed near the surface of a hill. In this technique a single near horizontal or multiple layers are dug into the mineral layer. Explosives are used to blast and loosen the rock. Once this has been carried out, pillars and steel nets are installed. This prevents the roof of mine from caving in and steel nets prevent rocks from falling down and killing the miners. Then diggers are used to remove the mineral bearing rock and which is then transported by rail or donkeys to the mine entrance after which is loaded into trucks

- **Shaft** mining is used when the mineral layer is found deep in the soil. First a vertical layer is dug to reach the mineral layer. Once the mineral layer is reached then a horizontal layer is dug in both sides into the mineral layer. Explosives are used to blast and loosen the rock. Once this has been carried out then pillars and steel nets are installed. This prevents the roof of mine from caving in and steel nets prevent rocks from falling down and killing the miners. Then diggers are used to remove the mineral containing rock after it has been blasted apart by dynamites. This is then transported by rail to the lift, whereas then it is lifted to the surface to be transported by trucks. It must be noted that ventilation shafts are also dug along the length of mine along with main shaft to prevent the build-up of explosive odourless gases like methane

- **Opencast** mining is used when the mineral layer is exposed near the surface of the earth. Firstly the vegetation is cut, topsoil and subsoil removed. Then explosives are used to blast and loosen the rock. Then diggers are used to remove the mineral containing rock which is then transported by huge trucks carrying 500 tonnes in one go onto the surface. Opencast mine is a big hole in the ground with pathways for trucks running on the diameter of the mine



Fig6.5

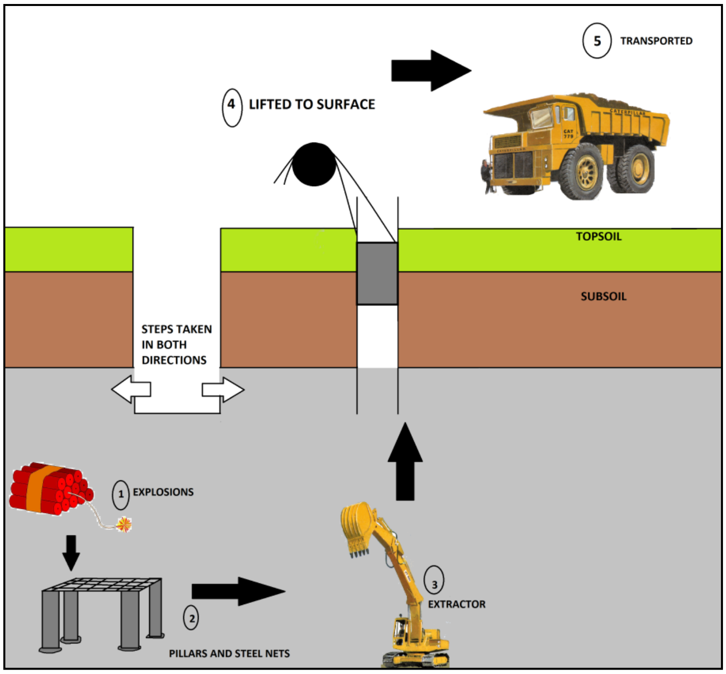


Fig6.4

- These methods of mining are used for coal, copper, and other metallic minerals like uranium etc

FACTORS AFFECTING MINERAL PRODUCTION

Topography

Thick, unbroken layers with little or no water are easy to mine. No methane gas is present, which can lead to explosions. No excessive folding and faulting is present and no steep slopes of the mineral layer. All this means that machines can be easily used as they have more room for manoeuvring.

Large and good quality reserves also encourage higher output.

Location

Climate is easy to work in, no extreme cold or heat. No flooding due to heavy downpour occurs, leading to less mine closures and thus more production

Commodity Prices

Higher commodity prices mean that the mining company will be able to earn more per kg of mineral and thus will likely keep most of

its mines open due to little risk of loss even from the most inefficient ones

- **Transport**

Good access to road network means that the processed mineral is easily and cheaply transported to where it is required. Also it becomes easier for trained labour to come from other parts of country etc

- **Ownership**

Some owners are willing to invest more in new technology to increase production which leads to more profit etc

EFFECTS OF MINING

- **Economical**

Mining brings jobs to the local people, which provides them with employment opportunities and raises their income, which in turn raises the standard of their living.

The country can export the mined mineral and earn foreign exchange or reduce the import of a mineral. The capital saved can be used to build schools and colleges etc

- **Environmental**

The environmental impacts of mining are huge and catastrophic if check on the environment aren't carried out and environment laws aren't enforced. This is because many mining companies are always looking to reduce their costs by either dumping waste illegally or not treating it properly

Opencast mines leave a huge hole on the surface. If it is not filled after mining has been finished it can be filled partly by rain water. This can lead to leaching of dangerous substances like arsenic into the ground water (water table) thus poisoning the water supply

At times the solid waste is dumped onto the surface and when it rains heavily, this dump can become unstable and flow into rivers and streams thus killing fish

Also local wildlife may move out of the area due to constant sound of explosions and vibrations**.** Trucks and chimneys can also cause air pollution

- **Miners**

Miners can suffer the most especially if they aren't given proper safety gears like masks etc or clean food and water. This can lead to lung cancer. Also, if proper ventilation systems aren't installed, explosions can occur due to collection of methane in the mine

The miners may also drown if they accidentally hit an underground reservoir of water or they may be trapped if the roof caves in

PAKISTAN'S MINERAL IMPORTS

- **IRON AND STEEL**

Pakistan imports around $400 million worth of iron and steel related products annually from countries like Japan, Russia, and Ukraine etc

COAL

Pakistan imports around $300 million of coal and related products from countries like South Africa and Indonesia

CRUDE OIL AND PETROLEUM PRODUCTS

Pakistan imports around $5 billion worth of these products, from countries like Saudi Arabia, UAE and Qatar etc

DESCRIBING PRODUCTION TRENDS

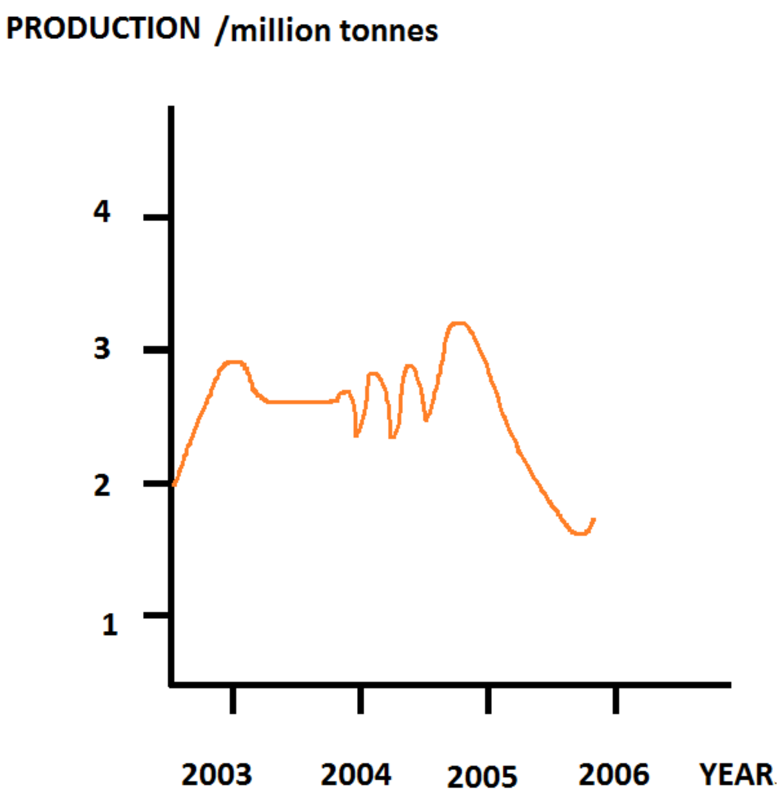


Fig6.6

- In this assumed example, from 2002-2003 production **rose steadily** from **2 to 3 million tonnes**
- At the end of 2003 it started **decreasing slowly** and became **constant** till the start of 2004
- From 2004-2005 it **widely fluctuated** between **2.4-3.5 million tonnes**. The **maximum** production of **3.5 million tonnes was reached at end of 2005**
- From 2005-2006, the production **decreased sharply** reaching its **lowest point of 1.5 million tonnes** in around the end of 2005
- At the beginning of 2006, production **began to increase slowly**

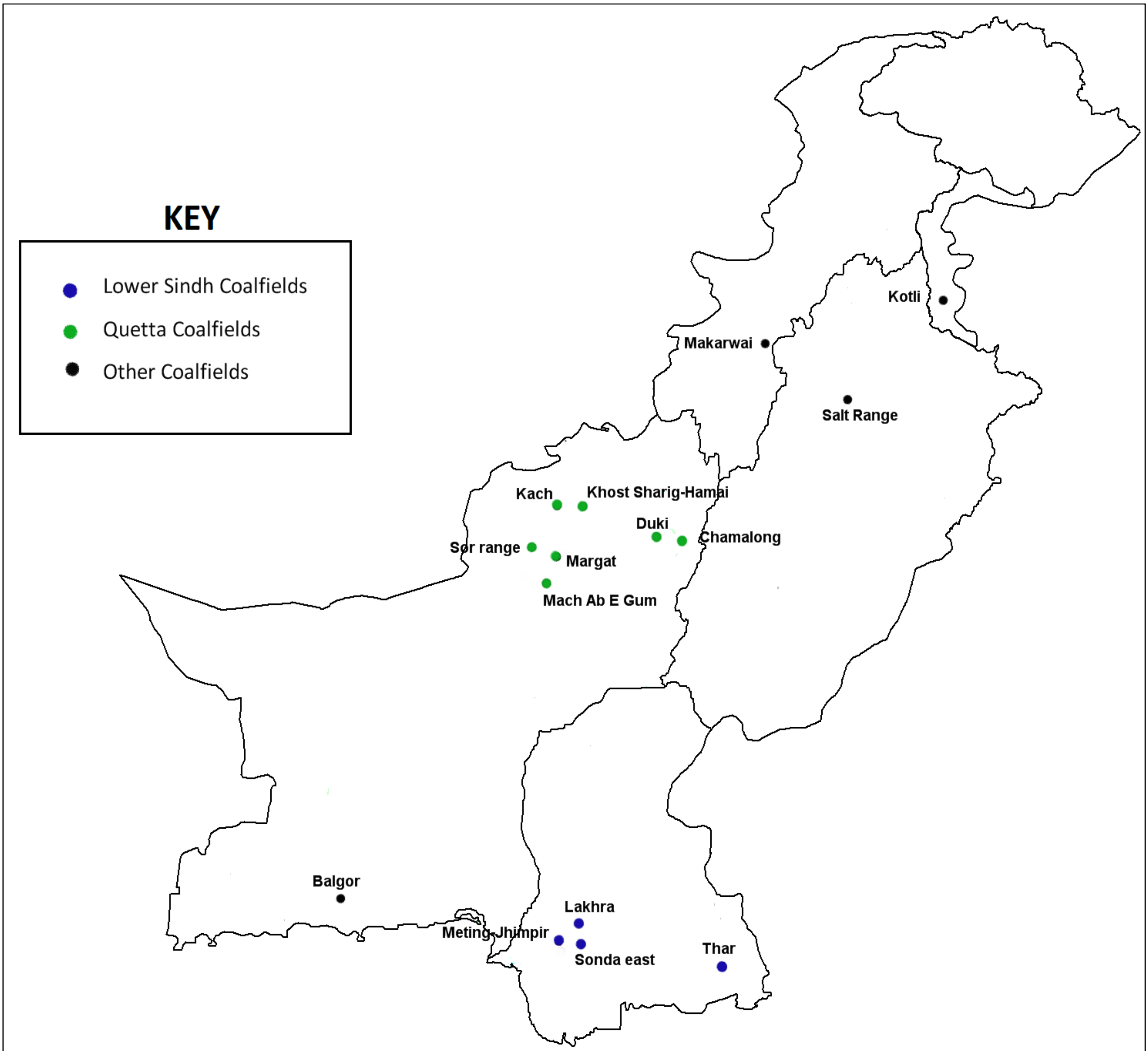


Fig6.7

COAL OF PAKISTAN

➢ RESERVES AND DEMAND

Pakistan's coal reserves are around 185,000 million tonnes, current production is 3 million tonnes

➢ QUALITY

The main problem with coal found in Pakistan is its quality. Quality is judged from variety of factors including carbon content, moisture content, ash and sulphur content, and last but not least the heating value. Most of coal found in Pakistan falls around either lignite or sub-bituminous category

The categories for classifying quality include

- ***Lignite***, also referred to as brown coal, is the lowest rank of coal and used almost

exclusively as fuel for electric power generation

- ***Sub-bituminous coal***, whose properties range from those of lignite to those of bituminous coal, is used primarily as fuel for steam-electric power generation.
- ***Bituminous coal***, dense mineral, black but sometimes dark brown, used primarily as fuel in steam-electric power generation, with substantial quantities also used for heat and power applications in manufacturing and to make coke
- ***Anthracite***, the highest rank; a harder, glossy, black coal used primarily for residential and commercial space heating

Quality of coal from various coalfields

The quality of coal from Lower Sindh coalfields varies from lignite to sub-bituminous. Coal from Thar has lower ash and sulphur content and higher heating value as compared to field at Lakhra. Lakhra coal dries up and has lower moisture content when brought to surface but it crumbles when exposed to air and can combust spontaneously

The quality of coal in Balochistan ranges from sub-bituminous to bituminous. Coal from Sor has low ash and sulphur content and high carbon content, as compared to all coalfields in Balochistan

The quality of coal from Punjab and Khyber-Pakhtunkhwa also ranges from sub-bituminous to bituminous. Coal from Makerwal is superior as it has high carbon, low ash and sulphur content and higher heating value as compared to Salt range coal

USES AND IMPORT OF COAL

Most of coal found in Pakistan is used to make bricks around 80% and rest is used by cement industry, which blends it with imported coal to reduce their costs. The coal used for power generation is first washed to reduce its sulphur and ash content. Coal can also be turned into a gas, and then used as a fuel

Pakistan Steel industry has to import higher graded coal from countries like South Africa, Australia and Indonesia to meet its current demands. This is because the coal found in Pakistan is of poor quality (high ash and sulphur content/low heating value); it is unsuitable to be used in steel production. Also. the production coal in Pakistan is too low, as coal seams are thin and mineral layers have a lot of faults. Thus, it is very difficult to operate machines and Pakistan doesn't have the finances to explore and utilize new mines

The local coal is carried out of the mine by donkeys or sometimes by humans on their backs. After this, the coal is loaded onto trucks and taken to the nearest market. In more mechanized mines, the coal is carried by rail.

Imported coal is unloaded at the port and checked by customs. After the import duty has been paid it is allowed to leave the port area

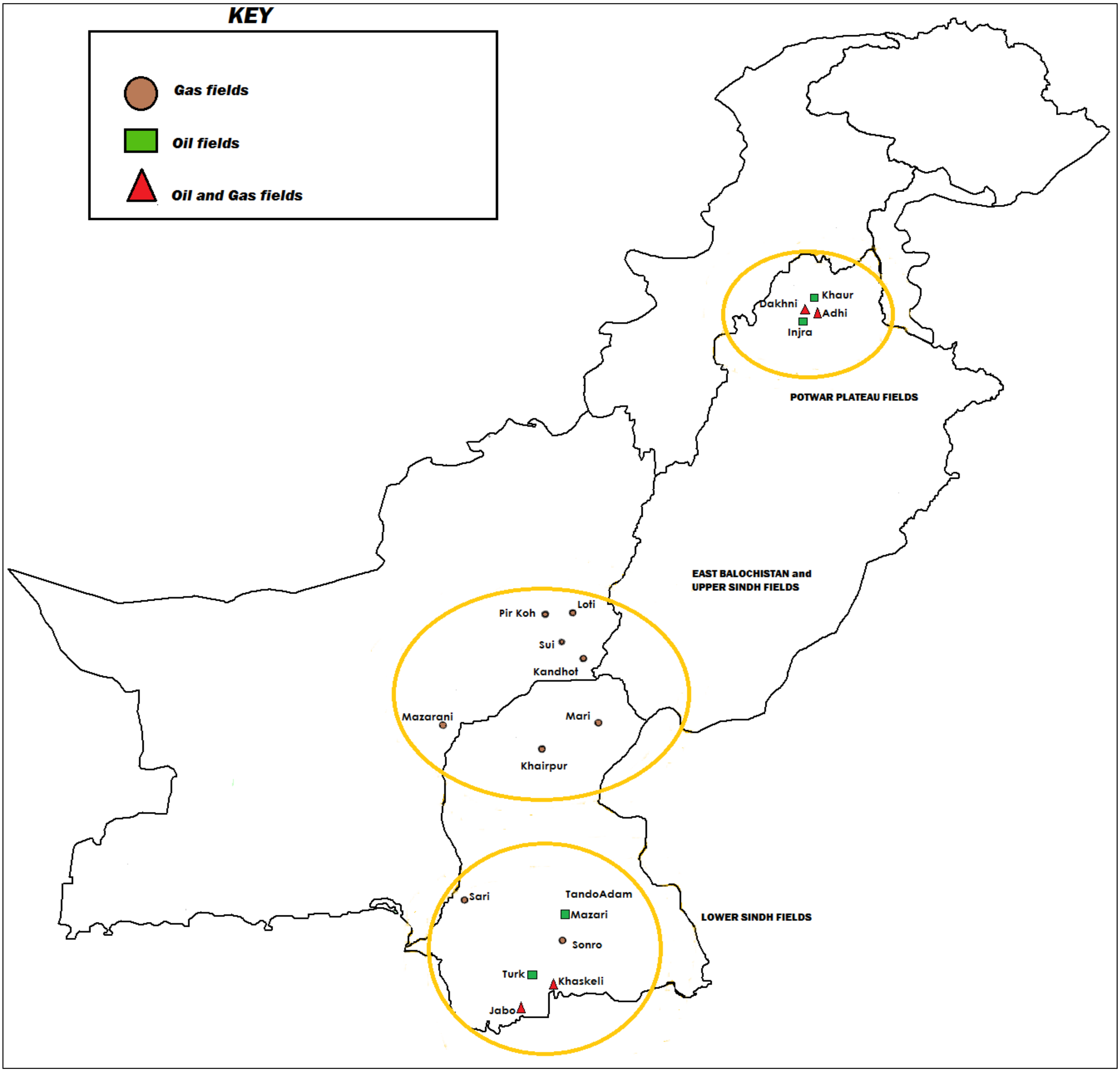


Fig6.8

NATURAL GAS OF PAKISTAN

RESERVES AND DEMAND

Pakistan's gas reserves are around 27-42 trillion cubic feet, while annual production is 900,000 million cubic feet. So at current rate of consumption the reserves will last around 30-45 years

USAGE AND TRANSPORT

Natural gas is used as a fuel for cars, about 2.5 million of them in Pakistan. Also, it is used for making fertilizers, for cooking, making hydrogen and other organic compounds like methanol etc

Natural gas is transported on land by two means; pipelines and cylinders. The infrastructure of pipelines in Pakistan will be explained later. The use of cylinders means that only little amount of gas can be carried at once. Refilling takes time, risk of explosion due to faulty cylinders is an added concern. The cylinders are heavy and difficult to move

The demand for natural gas is increasing due to use of CNG to run cars, making fertilizers (more demand), to generate power as it is cheaper than oil and coal, used for cooking in homes (as it burns cleanly and is easy to transport)

OIL OF PAKISTAN

➢ RESERVES AND DEMAND

Pakistan's oil reserves are around 300-700 million barrels, while annual production is 24 million barrels. So at current rate of consumption the reserves will last around 12-30 years. To fulfil its demands, Pakistan imports around 116 million barrels per year

➢ USAGE AND TRANSPORT

Oil is used to make solvents, roads, jet fuel, wax, lubricants, fuel for cars, to produce electricity and polymers.

Oil is taken out from the ground at **OILFIELDS**, and it is separated into its constituent fractions (kerosene, petrol, diesel, wax etc) at **OIL REFINERIES.** Usually refineries are located closer to both oilfields and cities to reduce transport costs

REASONS FOR INCREASE IN OIL IMPORTS

- Increased electricity demand due to growing rural and urban population (homes). Most of electricity produced in Pakistan comes from these thermal power stations
- Growth of industries etc (wax, lubricants, solvents, fertilizers etc are manufactured locally to reduce import costs)
- Growing number of middle class families, which can afford cars etc (and buy refrigerators etc)
- Mechanization of farms (use of harvesters, tractors etc) which require fuel
- Use of diesel tubewell in villages to provide water for irrigation
- Use of new diesel locomotives in trains (modernization)
- Old oil wells have become less productive (they are inefficient; the maintenance cost is higher than the value of oil they produce). These wells don't produce profit and thus have been closed. Local production hasn't really increased
- There has been a lack of foreign investments in oil fields of Pakistan because of institutional mismanagement

Oil is transported by pipelines and tankers. The oil pipelines network in Pakistan will be explained later. Tankers are used to transport oil where pipelines can't go (due to topography or low demand, which means project isn't feasible) or where pipelines don't exist. This in turn is expensive in the long run as pipelines may require a lot of capital to build but are cheap to maintain. Tankers on other hand themselves require fuel and maintenance. Heavy tankers also cause damage to roads

Distribution of Oil Pipeline Network

➢ Sindh

- From the Port of Karachi, the **KMK pipeline** (Karachi to Mehmood Kot) originates. It carries imported oil and refined oil from refineries like Indus Refinery and Pakistan Refinery (both are in Karachi)
- From Port Qasim, the **White oil pipeline** begins; carrying refined imported oil north. The pipeline starts from the west bank of Indus river
- These two pipelines run on both banks of River Indus respectively and then enter into Southern Punjab

➢ Punjab

- These two pipelines meet at Mehmood Kot near Multan at **Mid-Country Oil Refinery** (serves demand of oil in Southern Punjab, Khyber-Pakhtunkhwa etc). From the refinery one pipelines branches east and other branches west into Khyber-Pakhtunkhwa
- The one that goes east it connects with Faisalabad. From there it heads in three directions that is North towards Kharian, South towards Sahiwal and East towards Machike

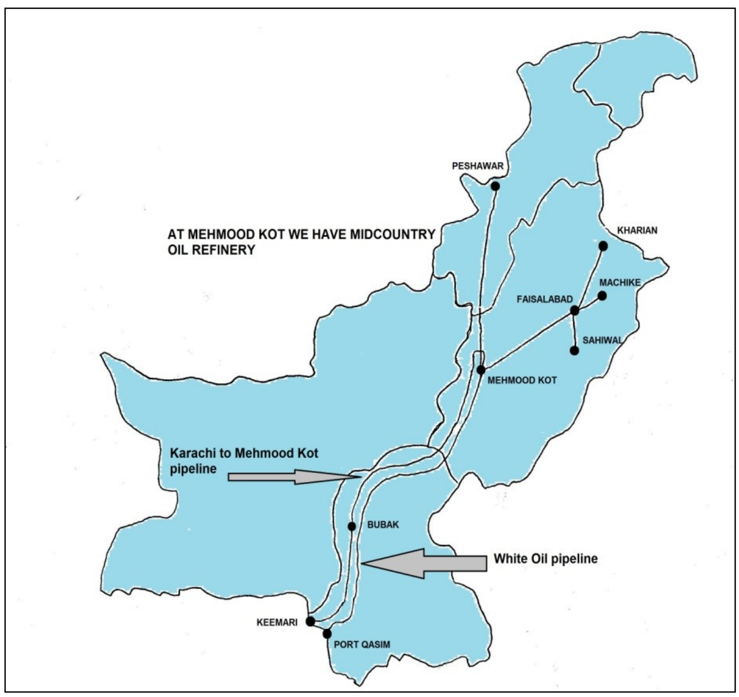
➢ Khyber-Pakhtunkhwa

- Pipeline enters from central Punjab and goes to Peshawar

➢ Balochistan

- A pipeline enters from Karachi into Hab, where the Hab Refinery refines oil to be used by industry in Hub Tehsil

Fig 6.9



Distribution of Gas Pipeline Network

➢ Sindh

- Two pipelines meet at Karachi. One branches east and crosses Indus. It connects Hyderabad with other gas producing fields in Lower Sindh and in Northern Sindh like Khairpur. This pipeline then enters Balochistan. From these fields does this pipeline start

- While the other runs on the west bank of Indus connecting field of Sari (from where it originates) and then it enters Southern Punjab

➢ Punjab and Khyber-Pakhtunkhwa

- Pipeline enters Southern Punjab and connects Multan with Faisalabad. At Faisalabad, it branches into two; one heading towards Lahore and other towards Islamabad.

- The pipeline reaches Lahore and has now been extended to Sialkot

- The other upon reaching Islamabad extends towards Peshawar

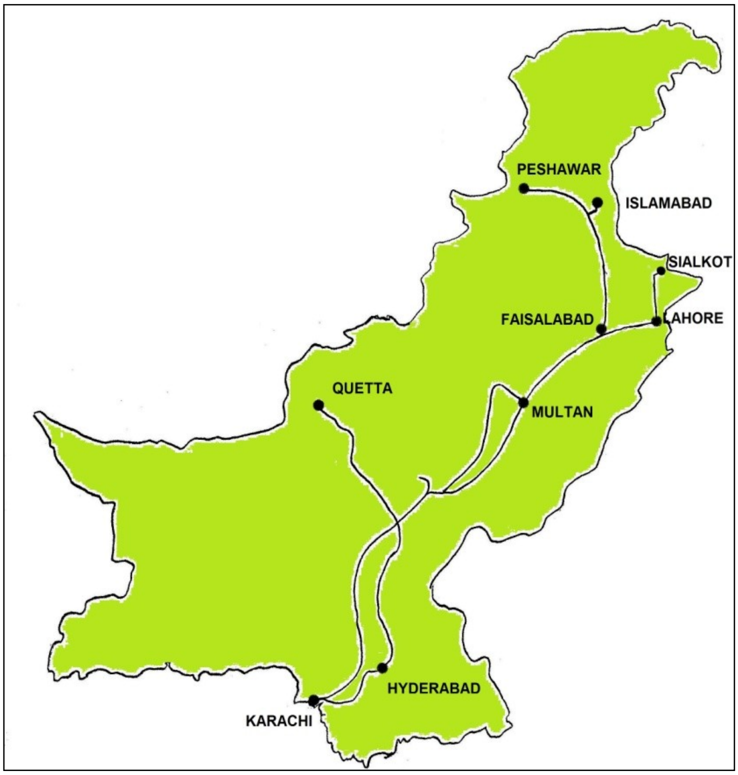


Fig6.10

➢ Balochistan

- A pipeline enters from Sindh and connects fields in Balochistan like Marri and Sui with Quetta

ELECTRICITY IN PAKISTAN

7

WIND TURBINE AT JHIMPIR, SINDH



PICTURE BY MASOOD AHMED

*Description and Distribution of Power Network

*Problems in the Power Network

*Potential of Energy Sources in Pakistan

*Advantages and Disadvantages of Renewable Energy Sources

*Advantages and Disadvantages of Non-renewable Energy Sources

ACKNOWLEDGEMENTS

Fig7.4 **Imran Naqvi and Mr.Grag**

ELECTRICITY IN PAKISTAN

Network

Pakistan has a grid network of electricity transmission; many power lines are inter-connected. This allows power to reach those areas where it is not produced. Power can also be provided to an area if its regional power station fails etc. But the grid system also results in losses due to resistance the current faces while travelling inside a wire. Also, the maintenance of long-distance power cables is another burden

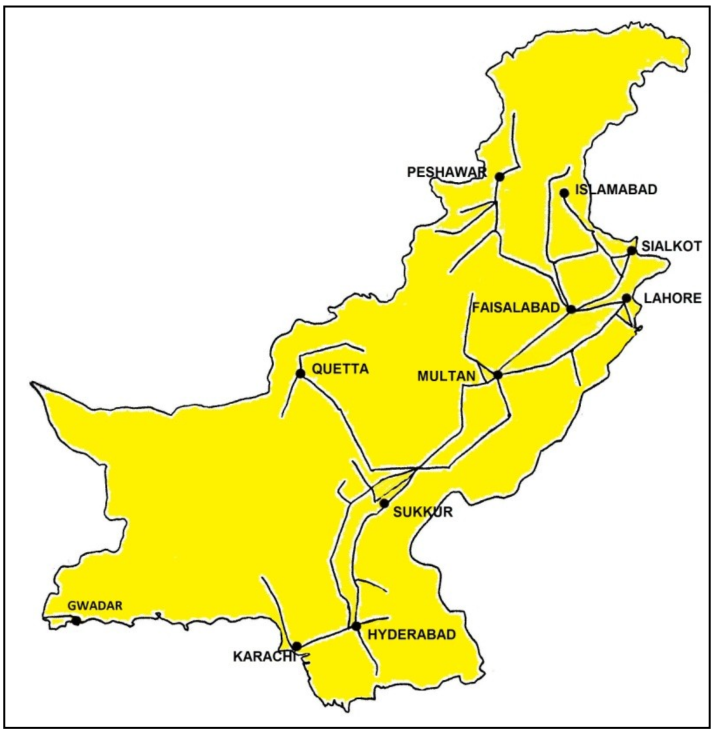


Fig7.1

- **Sindh**

- The powerlines run from Karachi connecting the nuclear power station there with Hyderabad. From there the lines start running on both banks of Indus and connect cities like Sukkur, Hyderabad etc

- **Punjab**

- Powerlines enter Southern Punjab from Sindh and run for some distance on both banks of Indus. They connect cities like Multan, Faisalabad, Lahore and Sialkot

- The powerlines run in a zigzag manner across the doabs and along Eastern tributaries of the River Indus

- These power lines are connected with thermal stations in Punjab along with the powerlines from Mangla dam, the nuclear power station at Chashma and other power projects like the Head of Qadirabad barrage (this barrage has turbines installed)

- **Balochistan**

- Here powerlines enter from Northern Sindh and are connected to Quetta along with adjoining areas. A coal power station near Quetta is also connected with the grid system

- On the Makran coast, electricity has been brought in from Iran and provided to Gwadar

- **Khyber-Pakhtunkhwa**

- Powerlines enter Khyber-Pakhtunkhwa from Punjab and connect cities like Peshawar and Mardan.

- Power stations like Tarbela and Warsak dams are also connected with the grid system

PROBLEMS IN THE POWER SECTOR

Massive problems exist in Pakistan's power sector. Institutional mismanagement has been the main cause for recent power outages. Power supply is limited to some areas and is not reliable

Most of the equipment is old and isn't replaced or maintained. Thus efficiency is low

Load Shedding

Load shedding occurs when electricity is shut down for one part of town and given to another part of town and vice versa

This means that many industries have either been forced to shut down as owners have to pay the labour even if they can't produce any goods. Sometimes if wages are reduced, labour leaves in search of other employment opportunities. This reduces exports and country's GDP

Also, machines may become faulty due to sudden outage of electricity or spike in voltage (during loadshedding) due to poorly maintained transformers etc. The products/goods may also be damaged due to loadshedding like for example ice cream

Industries may be forced to find their own electrical supplies, which are expensive like gas/petrol generators etc. This increases their cost of production, they have to sell their goods at higher price in local or foreign markets to avoid losses, but their goods may become in-competitive and company may lose market share.

Companies may also not be able to fulfil their order till the deadline (as machines need electricity) and thus may lose customers due to load shedding

Cost of Electricity

Rates for electricity are increasing thus discouraging foreign investors from investing as they will get lower profits. This leads to ageing machinery and lack of innovative ideas in the industrial sector, which hampers growth. In winters the amount of water in dams decreases, so does the production of electricity. Majority of the power units are thermal and running on oil, much of which is imported at a huge cost. Import is from a volatile region of Middle East, so supplies aren't always guaranteed. Also IPP's (Independent Power Producers) charge a higher rate for a unit of electricity produced than the rate at which electricity is provided to the common man, which leaves a budget deficit

Furthermore, the rampant theft of electricity means that the state owned WAPDA cannot pay all the power generators on time (therefore they don't generate electricity as they don't have money to buy furnace oil etc). WAPDA itself suffers a loss as the costs are made up from the state treasury. Thus the state gives less and less subsidies to the industrial sector

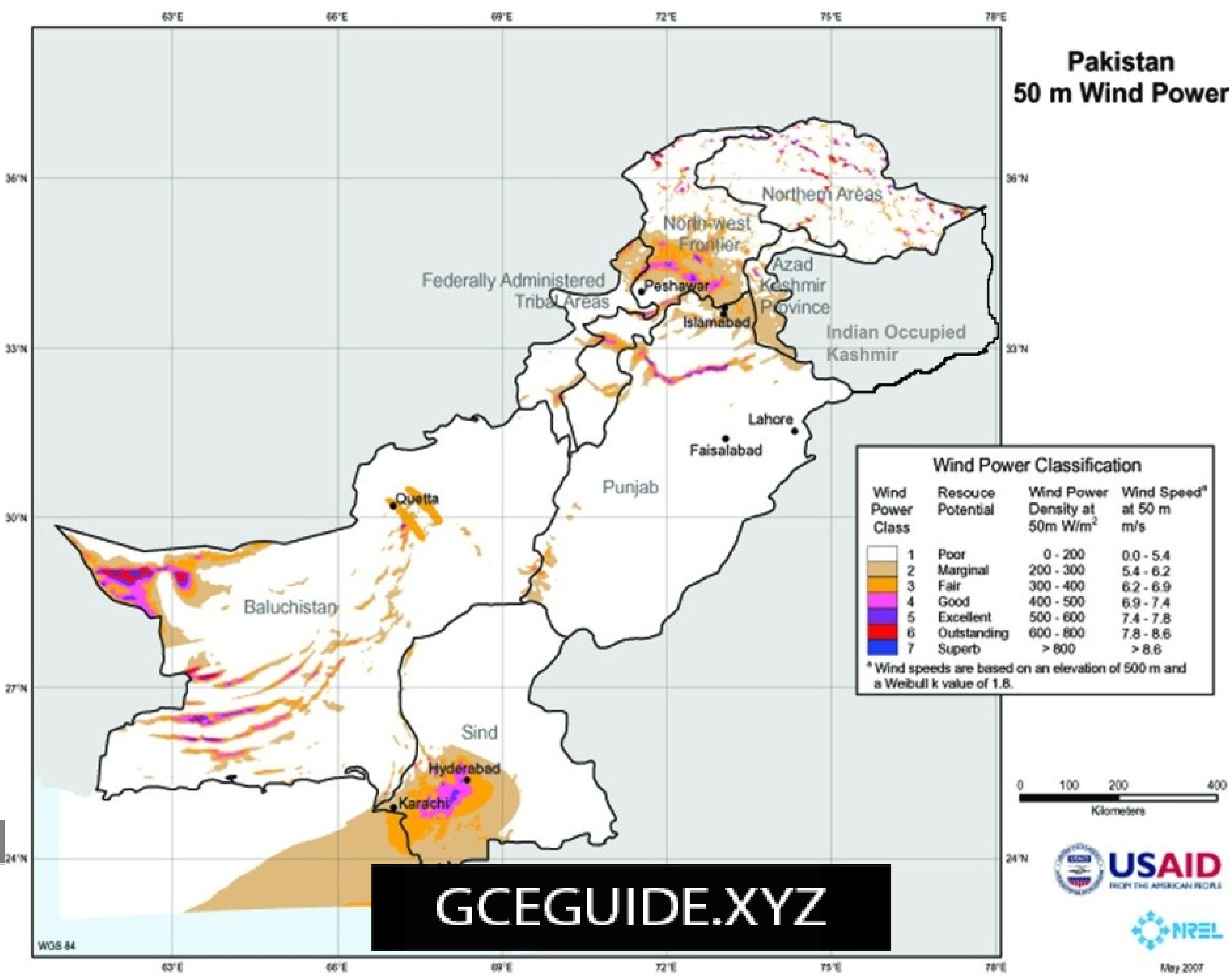
Also, it is expensive to lay down overhead cables from where electricity is produced to where demand is (like from Tarbela dam to Islamabad). The terrain is rough and capital costs are high, Losses are high too due to the

distances involved. Maintenance costs can also be significant

POTENTIAL AND FUTURE BENEFITS IF NEW PROJECTS ARE IMPLEMENTED

As said before the Thatta-Badin wind corridor has the potential to generate around 50,000 MW. A modern wind turbine can generate around 1.2MW in ideal conditions with the most advanced ones capable of more than 7 MW. It takes a million dollars to buy a 1.2MW wind turbine

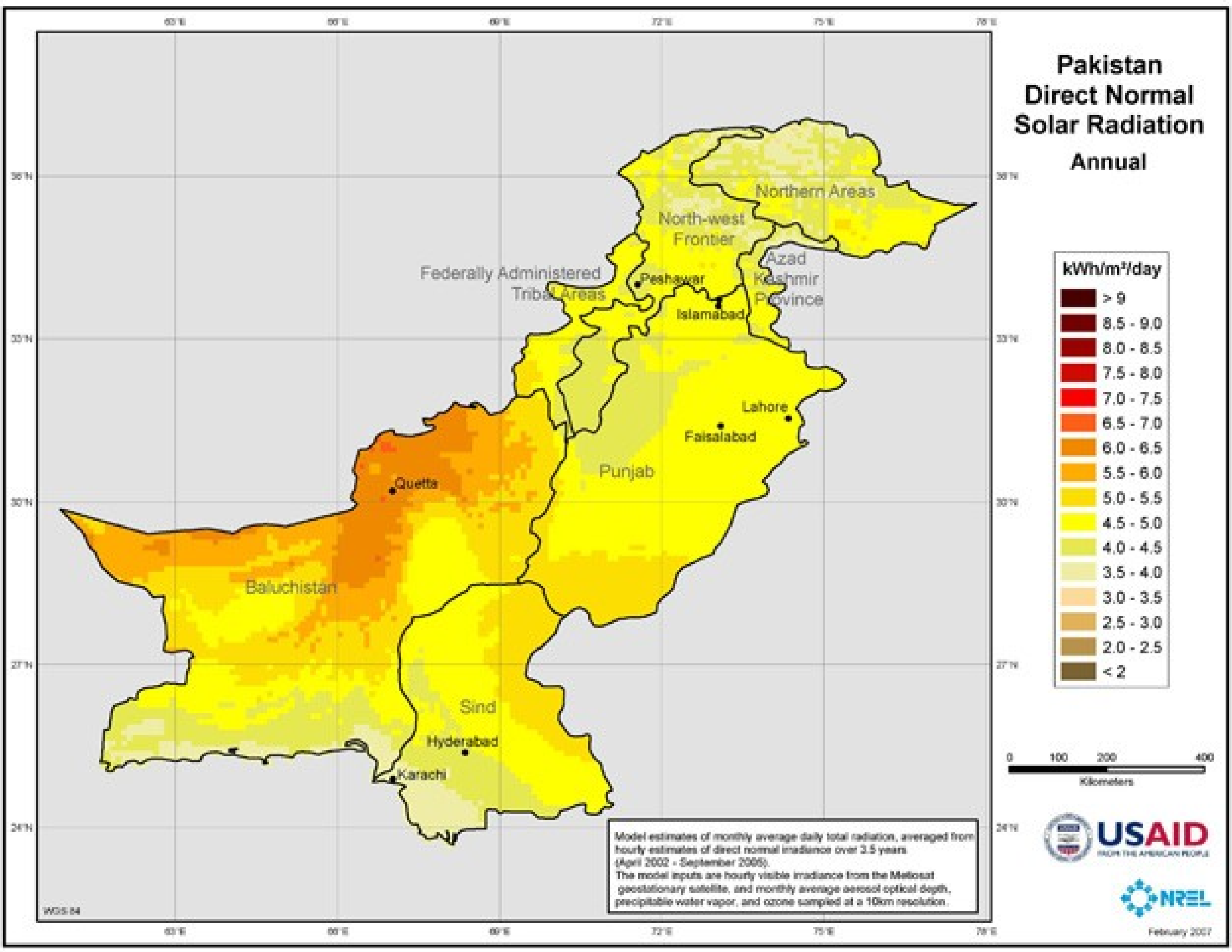
On the other hand, in the Northern areas there is the potential to generate around 46,000 MW of electricity through both small scale hydroelectric projects and big dams. SHP (small scale hydroelectric projects) are preferred because they don't have any reservoir and thus people aren't displaced. Also, water supply downstream isn't affected and also little if any forest area is flooded. They are water-runoff projects with a simple pipe through which water passes and turns the turbine. But the government still needs to invest or provide technical training to local turbine manufacturers as the quality of the components is below par. Small interest free loans may also help to speed up this process. A Rs.80,000 SHP project can provide 300W of



electricity

On the other hand solar power in Pakistan is a bit expensive. If government grants subsidies and banks are willing to give loans, then their use can significantly increase. On average a 2.5 kilowatts (average middle class house power consumption) can cost around $10,500. This is around 860,000 rupees. Large areas of Pakistan have more than 300 sunny days a year. These areas are also unpopulated like Kharan Desert

Biogas projects can also be implemented. On average a plant costs around 40,000 Rs. This provides methane gas to be used for cooking. If the size is up scaled, then enough gas can be produced to run a generator to produce electricity for a small village. It must be noted that rural electrification based on exploitation of local resources plays a significant role in economic development and improvement of living standards. It has been observed that skilled workers, teachers, doctors and nurses prefer to live and work in rural areas which are well connected to nearby urban centres and where electricity and communication services are available. However they are reluctant to work in areas where there is no electricity. Furthermore, TV's etc can help



farmers decide about when to plant, harvest their crops and show them advanced techniques. Education in rural areas can also be implemented in this fashion, if communication services are expanded

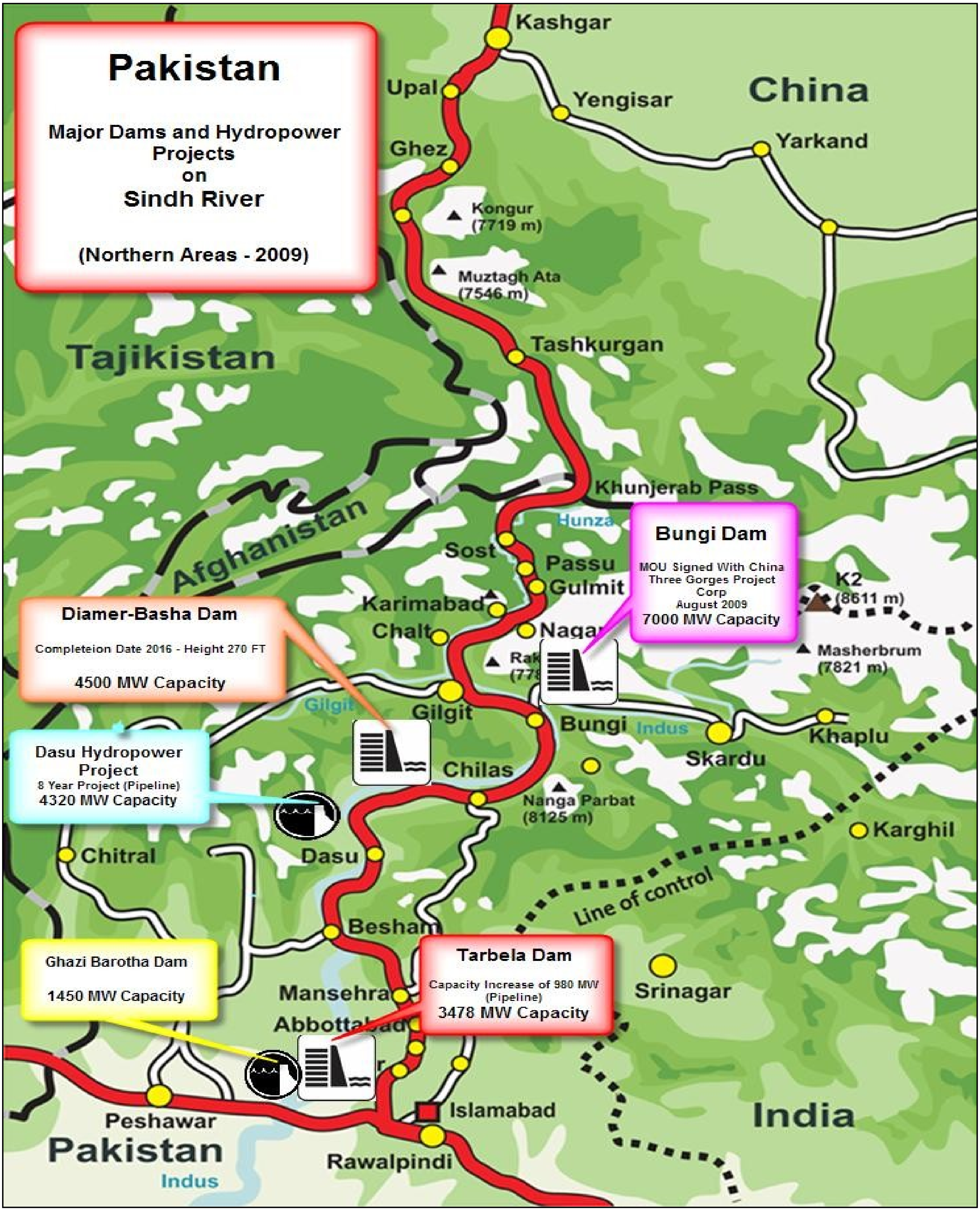
On the other hand Pakistan has potential to generate 50,000 MW of electricity from Thar Coal for 800 years! The current demand is 18,000MW

If these projects are implemented, the urban and rural landscape can dramatically change. The ample supply of power means that the country can afford to lower billing rates, thus encouraging foreign investment in the industrial sector. This will provide employment and raise living standard of people's lives. Moreover, exports are increased along with foreign exchange reserves

HOW A TURBINE AND A GRID SYSTEM WORKS (COAL, GAS, WIND AND HYDROELECTRIC POWER STATIONS)

A fluid (gas or water) moves past the blade of the turbine. The blade reacts to the flow of fluid and moves the rotor, which then turns a generator. This generator moves within a magnetic field, when it moves in a magnetic field a current is produced

The current produced has its voltage raised by a transformer. Then electricity is transmitted to the nearest grid station through overhanging power lines and electricity pylons (high voltage results in lesser loss of electricity). From here it is sent to the local grid stations by over hanging wires or underground cables. At the local grid situation the voltage is re-adjusted (lowered) and electricity is supplied according to the need



Pakistan
Major Dams and Hydropower Projects on Sindh River
(Northern Areas - 2009)
Kashgar
Upal
Ghez
Yengisar
China
Yarkand
Kongur (7719 m)
Muztagh Ata (7546 m)
Tajikistan
Tashkurgan
Afghanistan
Khunjerab Pass
Hunza
Bungi Dam
MOU Signed With China Three Gorges Project Corp August 2009
7000 MW Capacity
Sost
Passu
Gulmit
Karimabad
Chalt
Nagar
K2 (8611 m)
Masherbrum (7821 m)
Diamer-Basha Dam
Completeion Date 2016 - Height 270 FT
4500 MW Capacity
Gilgit
Bungi
Indus
Skardu
Khaplu
Chilas
Dasu Hydropower Project
8 Year Project (Pipeline)
4320 MW Capacity
Nanga Parbat (8125 m)
Karghil
Chitral
Dasu
Line of control
Besham
Ghazi Barotha Dam
1450 MW Capacity
Tarbela Dam
Capacity Increase of 980 MW (Pipeline)
3478 MW Capacity
Mansehra
Srinagar
Islamabad
Peshawar
Pakistan
Indus
Rawalpindi
India

Fig7.4

Renewable or Non-Renewable Energy

Renewable energy comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are renewable (naturally replenished)

A **non-renewable resource** is a natural resource which cannot be produced, grown, generated, or used on a scale which can sustain its consumption rate. These resources often exist in a fixed amount, or are consumed much faster than nature can create them. Fossil fuels (such as coal, petroleum and natural gas) and nuclear power (uranium) are examples

➢ Renewable

- #### Sunlight or Solar

Energy from the Sun can be utilized in the form of solar panels, which can generate electricity or heat water in homes. For generating electricity, these panels are installed in either deserts or large places of open and barren land. The panels absorb sunlight and use it to produce electricity free of cost except for the maintenance cost. On the other hand, these black panels absorb radiation from the sun and transfer it to the water to heat it



Fig7.5

Another way of generating electricity is to use mirrors in desert, which reflect sunlight on to a very concentrated place on a tower (which contains water). The concentrated rays of sun heat the water and convert it into steam thus rotating the turbines and generating electricity

- #### Hydroelectric

This is the most important source of renewable energy in the world today. Hydroelectric power stations use the force of running water to turn turbines, which turn the generator in a magnetic field, thus generating electricity. Conditions for a potential hydroelectric power site include

- A deep valley thus which can carry more water leading to more force at which turbines are turned. Also, a deep valley means that the water has more time to speed up and gather momentum before it hits the turbines

- A narrow valley to make sure that construction cost of dam for concrete etc remain low and project is feasible due to the

technical difficulties in building a wider dam wall

- A large reservoir so to store any un-required surge of water which might have been wasted during rainy seasons. If this water is stored in the reservoir then it can be used in future months to generate electricity
- The dam must not be located at or near a fault line. These areas are prone to earthquakes, which can fatally lead to dam failures, sudden flash floods and tragic loss of life

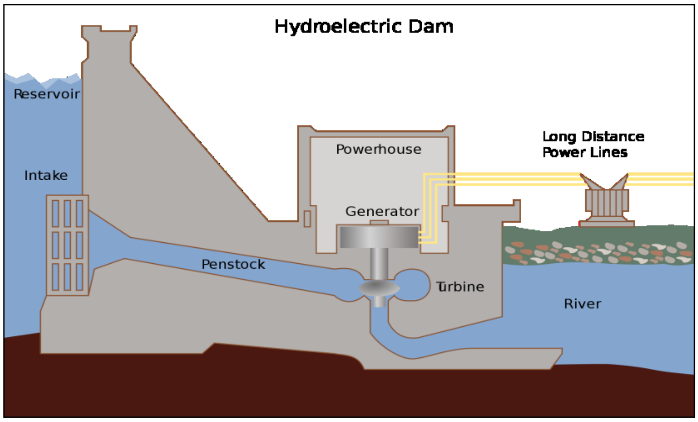


Fig7.6

- Impermeable layers of soil to prevent seepage and making sure that the reservoir of dam doesn't lose water too quickly
- River basin that is fed by glaciers. The glaciers melt and provide water. Also, the drainage basin must be large and be under influence of the monsoons etc
- River must pass through forested areas so that river carries low amount of silt. Trees roots bind the soil together and prevent flash floods (which erode more land) as they slow down the descent of rainfall. If this silt starts accumulating behind a dam wall it can cause some serious problems and reduce life of dams either by reducing their capacity or blocking spillways etc

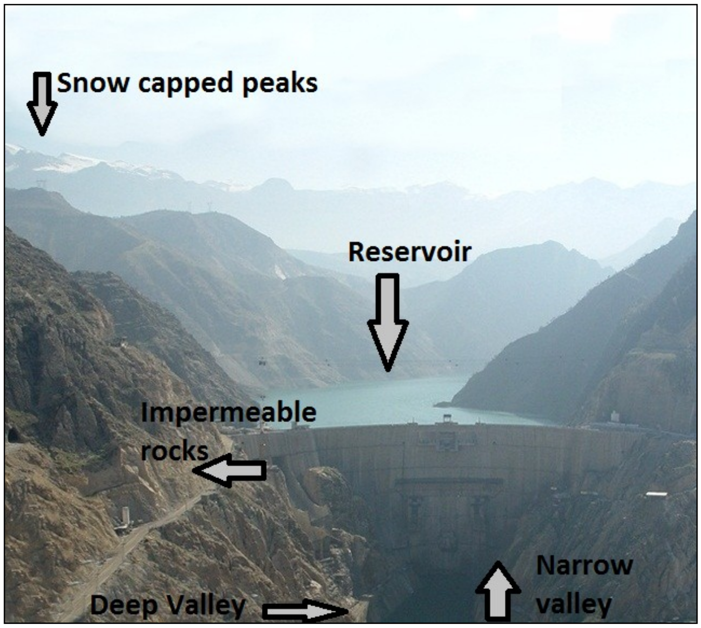


Fig7.7

- The average temperatures of the surrounding areas should be low, to keep the rate of evapo-transpiration to a minimum
- The dam must be located in a lowly populated area so the rehabilitation cost of citizens who are displaced is low

Geothermal

Geothermal power is used in countries where favourable topographical conditions exist like in New Zealand and Iceland such as geysers etc. Conditions like these exist in some places in Azad Kashmir like near Kotli etc



Fig7.8

Two big pipes are dug into the surface. These pipes reach hot rocks in the earth's crust. These rocks are heated up by the magma beneath them. From one pipe cold water is sent below and from other pipe hot steam or water is received. Through a heat exchanger system this heat is transferred to water in another pipe network. Here the water absorbs heat and becomes steam which is fed into turbines to generate electricity

- **Biomass**

It is the energy generated in form of electricity or heat from plants/organic matter etc

Dead leaves, branches, stumps etc are burnt directly to produce heat. In some countries garbage burning plants have been set up, which burn garbage and use the heat produced to turn water into steam. This steam then turns turbines, which produce electricity

One good use of biomass is in production of biogas. In a biogas plant, animal dung is fed into a closed container deprived of oxygen. Bacteria and other micro-organisms then digest it and produce methane as a result. This methane is used either for cooking or for producing electricity

- **Wind**

Wind energy is based on simple principles. A turbine is attached to a blade. This blade is mounted on a tower which is placed in a windy area such as on hillsides, near cost or off-shore. The force of wind, turns blade and thus turns the turbine; producing electricity



Fig7.9

- **Tidal**

There is much need for research and development before we see any large scale use of this form of energy. Tidal power uses same principles as wind except being installed on seabed and using force of tides to turn the blades. Currently it is very expensive to mount these turbines on seabed and the electricity produced is low

➢ Non-Renewable

• Coal

Energy is generated from coal when it is burnt in power stations and the heat produced is used to boil water and convert it into steam. This steam is then passed through turbines to generate electricity. It must be noted that most of coal found in Pakistan is of inferior quality and contains high ash and sulphur content. When it is burnt sulphur dioxide is produced which leads to acid rain. To counteract this problem, flue-gas desulfurization techniques must be employed to safeguard the environment.



Fig7.10

• Petroleum

Petroleum is used in typically the same way as coal is used to generate power. It is burnt too but like coal, it also has to go further processing before being used as a fuel, as we need to remove sulphur present in it too. Lead may also be present

• Gas

Gas is also used in the same way as oil and coal are used to generate power. It also goes under processing before it is fed into power stations, which means removing harmful substances like cyanide etc

• Nuclear or Uranium

It is one of the most powerful but also the most dangerous fuel in the world.

A kilogram of coal produces 24 million joules of energy; compare it with Uranium 500,000 million joules per kg! But 1986 nuclear disaster at Chernobyl showed the world the horrors of nuclear age when a reactor exploded leading to radiation fall out and birth deformities and cancers etc to hundreds and thousands of people. In nuclear power, the reactor is encased in a thick lead shield to protect from radiation while fission occurs. Fission is breakdown of Uranium atoms into smaller atoms with release of massive amount of energy. This energy is mainly in form of heat and is used to heat water in other pipes through heat exchange systems. This water absorbs heat and is converted to steam which then turns the turbine to produce electricity.

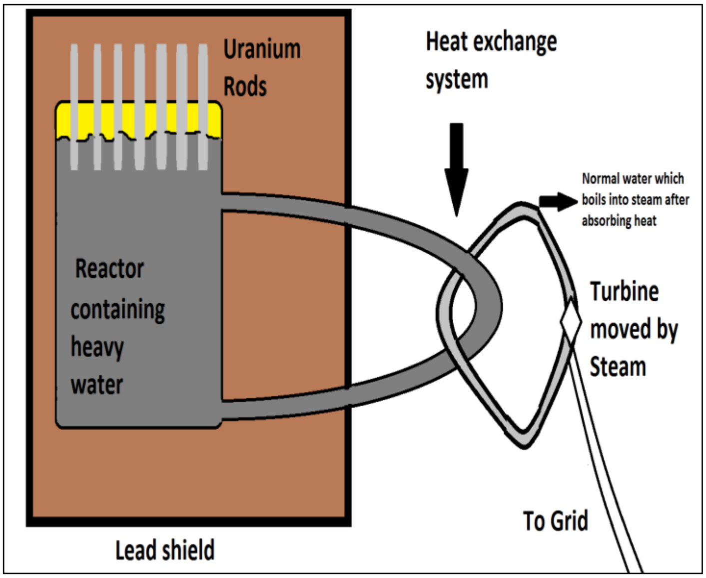


Fig7.11

It is said that the nuclear power plants the Chinese are helping to build in Pakistan were designed in the 1970's. The Chinese government cannot pass the latest technology concerning nuclear reactor design as they are the property of the western governments, which the Chinese have agreed to use, not to sell or pass onto other governments. One can very well imagine the possibility of a disaster in these oldly designed reactors

ADVANTAGES AND DISADVANTAGES OF RENEWABLE SOURCES

ADVANTAGES

- As their name suggests, they are renewable meaning that unlike non-renewable energy they will never run out
- Renewable are mostly clean and have little lasting impact on environment
- They require investment once only and maintenance thereafter, no need to buy fuel like fossil fuels etc. So they are cheaper in the long run
- They can be used in remote areas (wind power in mountainous areas), where other power resources can't be used due to difficulty of transporting furnace oil etc. Also, these areas may be far away from the national grid (It is uneconomical to extend the grid to small population centres as the wires and pylons are expensive)
- The supply of fossil fuels is very unstable due to conflicts in the Middle East, thus to have secure energy supplies in the future, Pakistan should develop renewable energy

DISADVANTAGES

- Solar energy is not much efficient, about 20%, when converting light energy from the sun into electricity; also it requires regular maintenance to remove dust which can cut efficiency by 3/4th. Also the panels must tilt with time of day and location of sun to maintain maximum efficiency
- Some dangerous substances like cadmium are used to make solar panels and raise questions about how they will be dealt in future when their lifetime has expired
- Wind turbines produce an audible sound which locals hate and it also spoils the scenery. Also not many places have many windy days
- Geo-thermal isn't available at all places in the world and few favourable places exist. Also it leads to Carbon Dioxide emissions which lead

to global warming; melting of polar ice caps and floods of low lying areas

- Less water is available downstream due to dams, thus affecting fisheries as mangroves don't get enough fresh water. Agriculture may also be affected due to lack of water for plant growth
- Biomass produces limited amount of energy and is unfeasible to sustain current power demands
- Wind and solar power aren't available at all times like during windless days or cloudy days or nights
- All of the renewable sources require large amounts of capital to produce single megawatt of electricity as compared to fossil fuels
- In hydel projects immense costs are incurred due to:
    - Large scale planning and research costs, which involves dam design etc
    - Evacuation procedures along with resettlement of people affected by the reservoir of the dam
    - Building roads (for access to site) and tunnels (to channel water into the turbines)
    - Laying down power lines and connecting them to the grid system
    - hiring professionals (engineers etc) and workers and accommodating them on site
    - Buying expensive heavy machinery and maintaining it
    - Buying raw materials like cement and steel in exceptionally large quantities
- Hydro-electric causes massive displacement of people and loss of livelihood. Forests are flooded and killed; the trees then decay and produce methane, leading to global warming

ADVANTAGES AND DISADVANTAGES OF NON-RENEWABLE SOURCES

ADVANTAGES

- They require low initial investment as compared to renewable sources, and are perfect for urgently meeting demands as they require less time to build
- Electricity can be produced on large scale as no know how of advanced engineering like those involved in big dams etc is required
- The technology exists and therefore there are no research costs

DISADVANTAGES

- These energy sources are non-renewable meaning that they will eventually run out and can't be depended upon in the long run
- They pollute the environment leading to acid rain or global warming. Acid rain kills trees and aquatic life. Also nuclear power produces wastes which remain radioactive for thousands of years and need to be stored underground safely for that period of time

- Due to conflicts in fossil fuel rich Middle East, the price of these fossils fuels looks set to rise, so Pakistan won't be able to import much oil to produce electricity in the future
- These projects however do require a lot of expensive maintenance and fuel, so are expensive in the long run. Also, **Independent Power Producers** charge a higher rate for electricity generation than state owned thermal stations
- Due to gas cuts in both industrial and power sector, it seems that relying heavily upon gas thermal stations isn't a reliable option in the long run

AGRICULTURE IN PAKISTAN

8



PICTURE BY SARFRAZ HAYAT

*Farming Procedures

*Types of Farming
Subsistence and Cash Crop

*Main crops
Wheat
Sugarcane
Rice
Cotton

*Other crops
Apricots
Mango
Tobacco
Millet
Date Palm
Citrus
Banana
Oilseeds
Maize

ACKNOWLEDGEMENTS

Fig8.1	**BRIAN HATHCOCK**
Fig8.2 and Fig8.3	**TODD KLASSY**
Fig8.4	**TIM**
Fig8.5	**RIZWAN RAFIQUE**
Fig8.6	**JASON HILL**
Fig8.7	**RONNIE PUCKET**

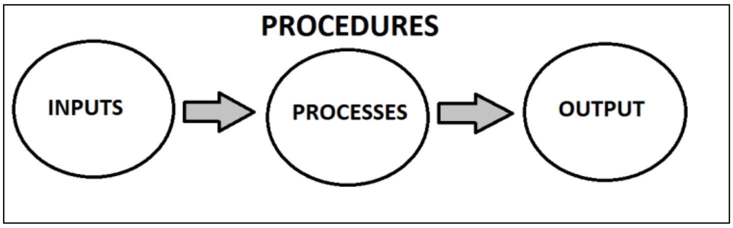
Definition

Agriculture is the process by which food crops and other goods are produce, including Wheat, Rice, Sugarcane, Maize along with Cotton etc.

Farming Procedures

❖ INPUTS

These are both **human** and **physical** resources that go into the farm.



➢ Human

Capital

This is all the money and machinery that is invested into the farm including tractor and harvester etc

Fertilizer

These replace the nutrients that have been used up by the crop. With the use of fertilizers, nutrients are available for plant growth resulting in higher yields

Insecticides

These are sprayed to kill insects, which damage crop growth by eating leaves etc. Unfortunately, insecticides also harm other useful insects and organisms like butterfly, which are vital for pollination

Labour

Labour is all the human effort that is put in from the time of plantation of crop to the time of harvest.

Seeds

A desi variety of seeds produces lower yields as compared to a high yielding variety of seeds. But it must be noted that only desi varieties are adapted to the local climatic conditions. Therefore to achieve high yields in an adverse climate a hybrid of the two varieties is required

Land Reforms

The government has introduced land reforms to consolidate the holdings of farmers, so that their far flung fields can be combined to form one big economically viable field. It thus becomes easier to use machines on it, obtaining loans becomes easier (as banks are more confident that farmer will be successful after using their money and will be able to repay the loan), farmer can experiment on his field and can ultimately save the time and hassle of working on multiple farms (this allows him more time to improve things like water supply to a single farm etc, all of which increase crop yields even further)

Also, land is taken away from landlords and given to poor tenants, thus unproductive land is brought into use. Furthermore, tenants have the ability to buy the land they have worked on when the landlord wants to sell it.

Government Support

The government supports the farmers by giving them interest free or low interest loans. These are used to buy machines and high yielding varieties of seeds

Also, the government supports the farmer by the implementation of the support price,

which is the minimum price per kg given to a farmer for his produce (this is independent of the demand and supply of the good). Support price is implemented to make sure that the farmer recovers his costs at harvest (when supply may be too high in pure capitalistic economies, the selling price of goods is too low and the farmer is eventually unable to recover his initial growing costs, thus he suffers a lost), so he has money to plant the next crop

Physical

Soil

Soil is the material in which the roots of the plant are embedded. A soil suitable for growth contains sufficient minerals for crop growth and also has sufficient pore spacing.

Pore spacing is important as it controls the amount of air and water available for plant roots. Too little spacing (clayey) soil means that it will contain less air and more water, thus won't support plant growth

On the contrary a sandy soil will allow air but will also allow a lot of water to infiltrate into the subsoil. This water may also take down with it fertilizers and other natural minerals (which are wasted as roots did not have time to absorb them)

The best soil is loamy soil, which contains sufficient pore spaces (to allow for sufficient air and moisture). Spaces aren't too big; so the soil does retain nutrients, which are not leached into the soil

The soil must be deep and must contain nitrates and phosphates; which are required for crop growth

Climate

Every crop has its own distinct climatic requirements. This includes rainfall, humidity, temperature, amount of sunlight etc.

In Pakistan, these requirements basically fall into two groups, Kharif and Rabi

These two groups are later explained under CROPS

PROCESSES

- Ploughing (turning over the upper layers of soil to bury weeds and the remains of previous crops, thereby, allowing them to break down, meanwhile bringing fresh nutrients to the surface)
- Sowing
- Spraying (Use of insecticides)
- Hoeing (Weed control by means of a hoe)
- Adding fertilizer
- Harvesting (cutting the crop)
- Threshing only in grain crops like Wheat, Maize, Rice, Millet (separating edible part of cereal from the scaly chaff)
- Selling

THIS ORDER MUST BE MAINTAINED AND MUST NOT BE ALTERED

OUTPUTS

- Crop wastes
- Food crops
- Seeds

Types of Farming

Subsistence

This type of farming is concerned with those farmers whose primary aim is to grow food to feed their own families. Any surplus of products produced during good years (when rainfall is plentiful and pests don't attack) is sold in local markets for some extra income. Surpluses are rare because traditional farming techniques are used, which give low production such as

- Wooden plough (pulled by a **bull**) is used, which barely ploughs the surface in comparison to the tractor (which ploughs very deep into the soil. With the use of wooden plough the fertility of land is low because less mixing of upper (nutrient deficient) and lower (nutrient bearing) layers of soil occurs. Also, exposing of the soil layer to air helps in nitrogen fixation, which fixes nitrogen in the soil. With a tractor plough it is easier for the bud to break through the soil, if that it is not the case then plant growth can be severely hampered and seed may not germinate at all

- Desi seed varieties are used. These give low yields as compared to high yielding varieties of seeds. The high yielding variety are produced from successive generations of parent plants all of whom give high yields

- Rainfall is the primary source of water for these subsistence farmers, since in Pakistan rainfall is variable in amount, intensity, distribution and timing. Thus, depending on rainfall for watering the crop is the least reliable method which gives low yields.

  Variance in amount means that one year we have a lot of rainfall and in the next year there is low amount of rainfall. This means that the farmer won't actually be able to know whether he should plant a water hungry crop like rice or a lesser water hungry crop like cotton etc
  Variance in intensity means that the rainfall either comes in one great downpour or comes in gentle strides. If the rain comes in the form of a downpour, then it is of little use to the farmer as the soil will have little time to absorb the water. This means that most of water won't get into the roots (less infiltration and more run off). The runoff will cause erosion (due to the force of running water), which will lead to flash floods. On the other hand if rain comes down slowly, then it will have more time to infiltrate the soil and will be much more useful.
  Too much cloud cover can mean that plants have less sunlight for growth and excessively moist conditions can lead to fungi attacks (crop rusting), which can be catastrophic

  Variance in distribution means that one district receives more rainfall than the other district, but the next year the opposite may happen. This means that the farmer won't actually be able to know whether he should plant a water hungry crop like rice or a lesser hungry crop like cotton etc

  Variance in timing means that one year most of the rain falls in the beginning few weeks of the rainy season, and next year most of the rain falls in the latter part of the rainy season. Thus the farmer has little idea as to when to plan for irrigation or separate source of water (if rains are insufficient)

- **Bull** (male) is used to plough the land (**not cow as cow is a female**), remove weeds, cut the crop (harvest), remove husk (by grinding) and transport the seeds and the grain etc. Buffalo they draw water from wells like Charsa or Noria etc

- Cattle/buffalo dung is used as a fertilizer for crops; this dung decomposes slowly, hence plant roots receive nutrients in small amounts as compared to artificial fertilizers. These artificial fertilizers dissolve quickly in water and have a broader range of minerals like phosphorous, sodium and potassium as compared to cattle/buffalo dung
- Since the area of farm under cultivation ranges from 0.25 – 10 acres, every year due to varying climatic conditions etc, production is variable (and most of the times low). Hired labour is rarely used as it is usually uneconomical (when the returns of a facility are lower than the amount spent to get it). Instead all members of family take part in at least one agricultural activity

- The farmer's crop is totally vulnerable to any attacks by fungi or pests because the farmer doesn't use any fungicide or pesticide. Therefore, year by year his crop yield can vary

- Since surpluses are rare, profits are also low so these farmers don't have much money to re-invest in the farm. Thus, they cannot buy high yielding varieties of seeds, farm machinery etc. Sometimes if they are lucky and the climatic conditions are right they may make a profit by selling the surplus which can be sold. The money earnt can be used to repair agricultural implements, buy **some** HYV's of seeds, improve water supply, buy **some** fertilizer or pesticide etc

- Sometimes the farmer may not find enough hired labour to harvest his crop on time. This because of rural-urban migration (explained in the last chapter), due to which many males move out from rural areas to find work in cities

- The farmer get sick and may not be fit on time (due to poor medical facilities in rural areas)

Commercial

This type of farming is concerned with making a vast profit by investing heavily in human inputs. This is done to achieve maximum possible yields and earn the highest possible level of profit upon sale. Inputs include:

- **Cash**
  This is the most important commodity for a commercial farmer. It is used to buy fertilizers, seeds, pesticides, machines etc. A commercial farmer he must have a lot of cash as this type of farming is mainly capital intensive

- **High Yielding Varieties of Seeds**
  These are the varieties of seeds which have been developed through selective breeding, a process in which plants with specific characteristics are pollinated with each other. This process is repeated on the next generation of plants until a totally new variety is developed with favourable characteristics such as, resistance to disease or pests, high yield, quick growth, strong stems, ability to survive in adverse conditions like high temperature and low rainfall etc
  Their use is encouraged by the government by the provision of subsidies (reduction in cost)

- **Fertilizers**
  They are used by farmers to increase crop yields. The fertilizer is added on to the soil, and then water is sprayed on it. The water dissolves the mineral ions and takes them into the root zone, where they are absorbed by the plant. Fertilizers replace the nutrients in the soil that have been used up by the crop. For example, Magnesium is required for photosynthesis to occur, which is a process by which plants make their own food etc

It is important that they are applied at the correct time in the right amounts

- **Pesticides**
  Pesticides are used by farmers to kill those pests which lower crop yields, for example to kill aphids which suck the sap of the plants. Sap is a sugary liquid that is used by the plant for its growth
  It is important that they are applied at the correct time in the right amounts

- **Irrigation**
  It is used to supplement the amount of water available for the crop from rainfall. In Pakistan, the amount, intensity, timing and distribution of rainfall are variable from year to year. So, irrigation (that is artificial supply of water) is necessary to compensate any shortage of water that may occur due to changing weather patterns. Low rainfall may result in lower yields and an eventual loss to the farmer

  Irrigation must be carefully managed so as to prevent waterlogging and salinity

- **Machines**
  Machines like combined harvesters quickly harvest the wheat crop; they separate the grain from the chaff. The stem of the wheat plant is quite weak and can break during the month of March; when thunderstorms accompanied with strong winds blow across the Punjab plains. If the stem breaks, then the grain will be exposed to water and leaving it vulnerable to fungi attacks (by a process known as rusting, which ruins the whole crop).

  By using a harvester a farmer can quickly harvest his crop before the storm hits. These machines are also very efficient (almost **ALL** of the grain is separated from the chaff, leading to higher profits for the farmer)

  But the cost of fuel, maintenance etc is high. The cost is further increased if skilled workers are hired to operate these machines etc. Machines are very expensive to buy.

  Also these machines can't be used on very small farms or farms which are located in mountainous terrain. Their use also results in unemployment in rural areas

CROPS

The crop season in Pakistan is divided into two parts. First is the Kharif season and second being the Rabi season.

Kharif season consists of crops planted around April-June and harvested in October-November. These include cotton, sugarcane, rice etc. These crops need high temperatures (25-40°C), so they can fulfil their necessary heat units required for their successful growth and harvest. Also, monsoon rains help to bridge the gap between amount of water available from irrigation and the water required by the crop. These crops also require a dry season for harvest

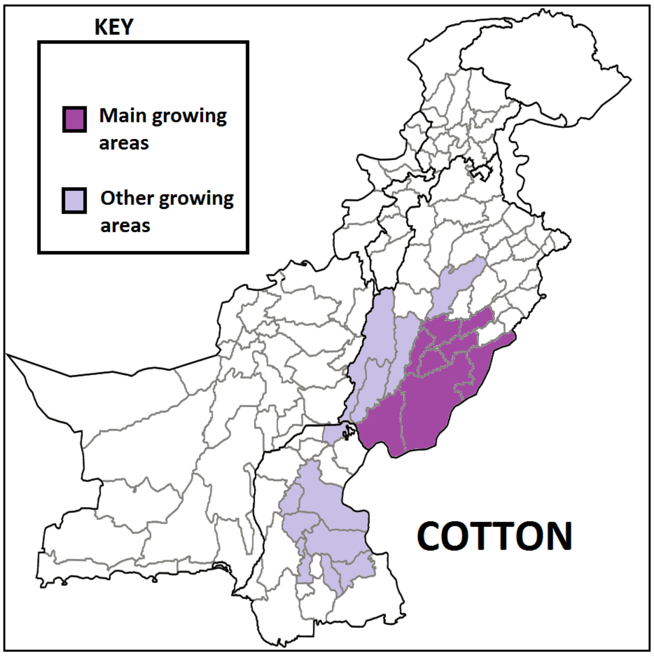
Rabi season consists of crops planted around Mid November- December and harvested during April – May. These crops require temperatures ranging from 15-35°C for their growth and harvest. Water requirements are moderate as compared to Kharif crops. These crops include Wheat, Maize, Pulses, and Oilseeds etc

Crop	Rainfall (mm)
Wheat	450 - 600
Rice	1200 - 2000
Sugarcane	1500 - 2000
Cotton	750 - 1300
Tobacco	400 - 600
Citrus	1000 - 1200

Cotton

Cotton is a Kharif crop that is planted in April-June and harvested in October-November. It is mainly grown in southern (arid) parts of Punjab, with other growing areas in eastern Sindh and other parts of southern Punjab

SEE AT END OF THIS CHAPTER THE DISTRICTS WHICH ARE TO BE LEARNED



Sowing

- Temperature during sowing must be from 25-30°C
- Before sowing, the seeds must be treated with chemicals to prevent seed born diseases
- The seeds must be sown with a driller to ensure a uniform depth of all the sowed seeds; this is to make sure that the plants reach stage of harvest at the same time. This is so because if the seed is sown too deep it won't germinate or if it even does so then its growth would be slow or stunted
- Sowing must occur in the anticipation of rain or immediately after it to take advantage of any moisture left in the soil

Growth

- Temperature during growth must be from 25-40°C
- 10 irrigations must be carried out with an interval of 10-12 days in between
- Weeds are removed by hand when needed

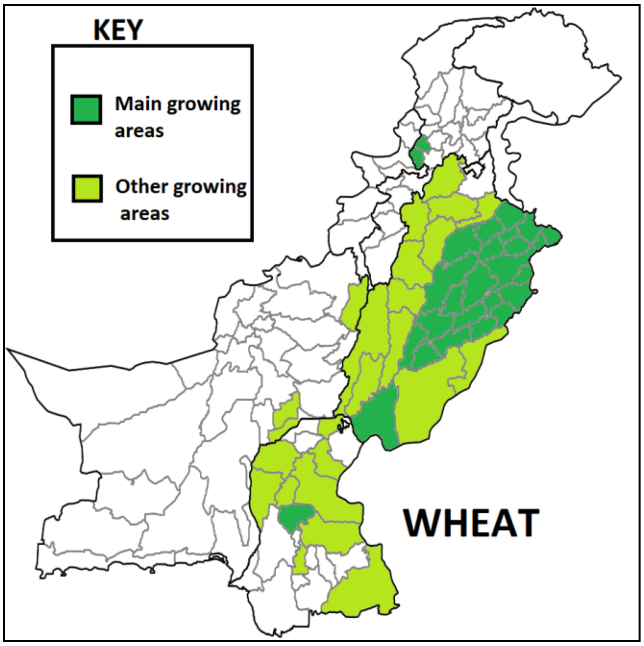


Fig8.1

Harvest

- Temperature during harvest must be from 30-32°C
- Harvesting is carried out when the bowls become dry and become fully open
- 1st picking is at 120 days, 2nd at 140 days and 3rd at 160 days. These pickings are done by women and children since the use of machines for cotton picking is expensive
- The diseased/ damaged bowls are kept separate from the fine quality bowls

Wheat



Wheat is a Rabi crop it is planted in Mid November – December and harvested around April - May. It is mostly grown throughout the central parts of Punjab with other growing areas including the rest of Punjab. Other growing areas are in eastern, central and western parts of Sindh

Sowing

- Temperature during the sowing must be from 4 - 25°C
- Before sowing, the seeds must be treated with fungicides to prevent born diseases
- The seeds must be sown with a driller to make sure uniform depth of sowed seeds. This is so because if the seed is sown too deep it won't germinate or if it even does so then its growth would be slow or stunted
- Sowing must occur in anticipation of rain from Western Depression or immediately after it to take advantage of any moisture left in the soil

Growth

- Temperature during growth must be from 15 - 30°C
- 4 irrigations must be carried out with 20 days interval in between
- Weeds are removed manually as in case of wheat this is very important. These weeds shed a lot of new seeds upon maturity, which can lead to explosion of weeds in the fields and cause massive loss to farmers
- Fertilizers and insecticides may be applied



Fig8.2 (During growth)

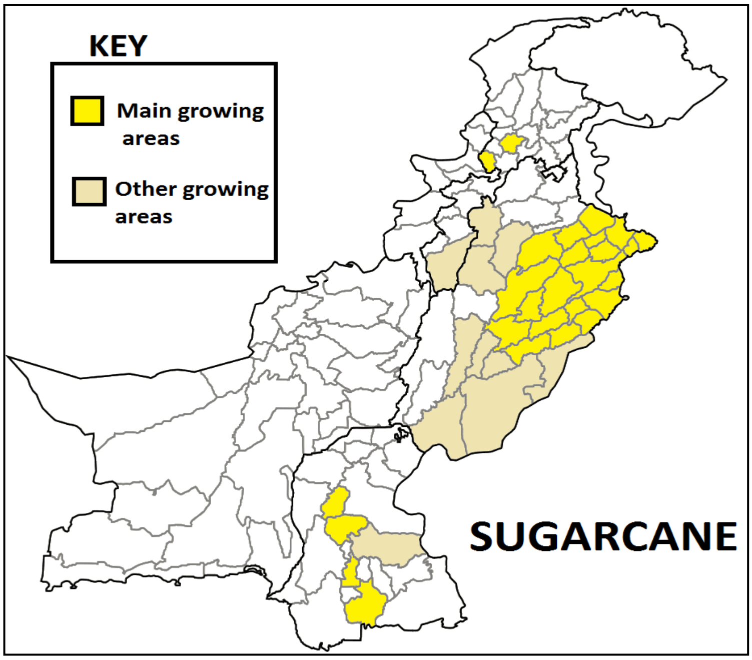
Harvest

- Temperature during harvest must be from 35-38°C along with sunny conditions
- Harvesting is carried out when the stems become brown with their height around 4 feet. The grain becoming hard too
- Harvest must be carried out before thunderstorms in March-April because these can produce strong winds accompanied with rain. The winds break the stem and expose the grain to standing water of the soil, this can result in fungi attack in condition known as rust (causing total crop loss)

Fig8.3



Sugarcane



Sugarcane is a Kharif crop that is planted in April-June and harvested in October-November

Sugarcane is mostly grown in central Punjab, central Sindh, and Peshawar along with adjoining district in Khyber-Pakhtunkhwa. Other growing areas include Western and Southern Punjab, along with parts of Eastern Sindh

Plantation (Not sowing)

- Temperature during the plantation must be from 30 - 35°C
- Sugarcane stalks should be planted at a row spacing of 90 cm to 1 m with the depth of not more than 4 inches

Growth

- Temperature during growth must be from 38-40°C
- 10 irrigations must be carried out with 10-12 days interval in between
- Weeds are removed manually when required
- Fertilizers and insecticides may be applied

Fig8.4



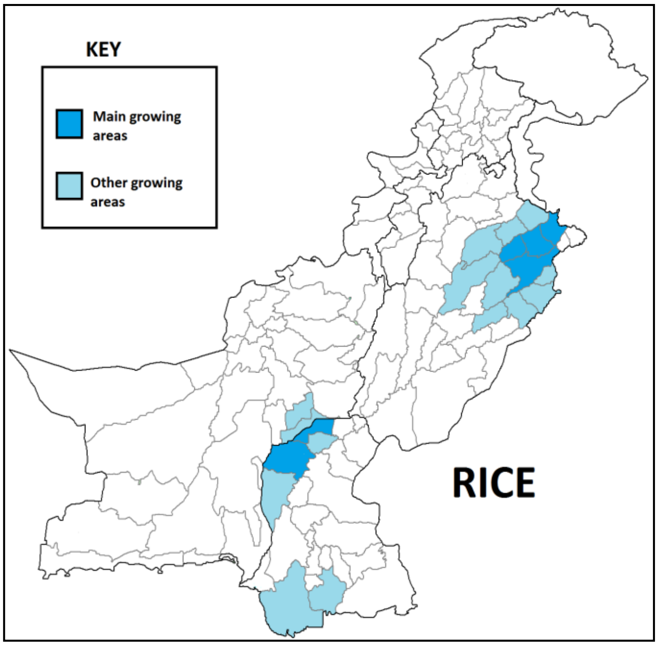
Harvest

- Temperature during harvest must be from 30-32°C
- Harvesting is carried out when the stem becomes hard
- The stem is cut above the ground and is immediately transported as any delay can lead to loss of sugar content and weight



Fig8.5

Rice



Rice is mainly grown in Western Sindh and Northeastern Punjab. Other growing areas include Eastern Punjab, Southern Sindh and parts of Eastern Balochistan

Preparation

- Firstly the rice seeds are planted in flooded nursery fields with uniform depth. They are kept in controlled temperatures and after 25 days they are transplanted in the fields
- Before transplantation the seeds must be treated with chemicals to prevent against seed born diseases

Sowing/Transplantation

- Temperature during transplantation must be from 30 - 35°C
- The land must be thoroughly ploughed and weeds should be removed before transplantation.
- Bunds are made and land is flooded

Growth

- Temperature during growth must be from 38-40°C
- The fields must be kept flooded all along the growth
- Fertilizers and insecticides may be applied



Fig8.6

Harvest

- Temperature during harvest must be from 30-32°C and the weather must be dry and sunny
- When the earheads start to show a golden colour, the bunds are broken and the fields are drained
- Harvesting is carried out when the earheads become golden and hard due to the weather

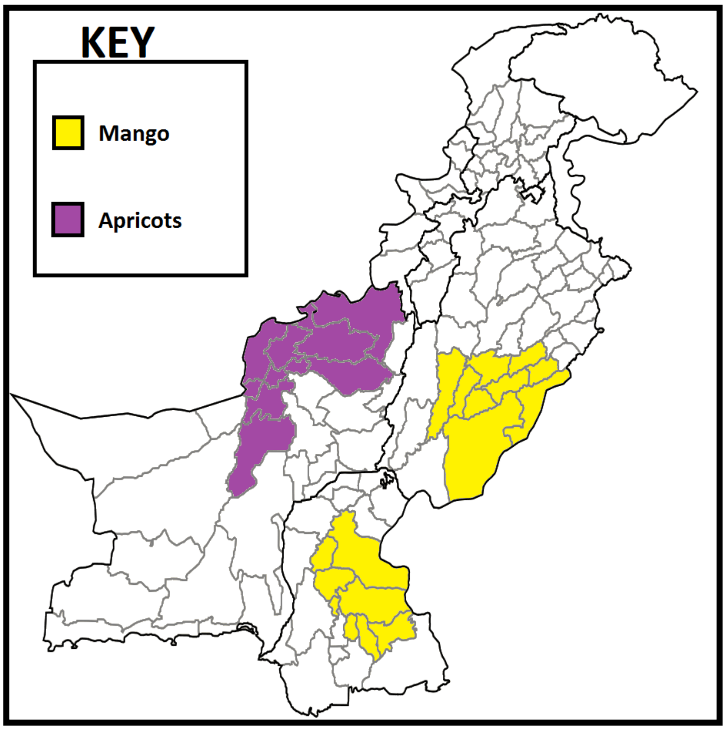
Fig8.7



OTHER CROPS

APRICOTS

Apricots are grown mainly in areas of mid-northern Balochistan. Pakistan is the 4^{th} largest producer of Apricots. The apricots need to fulfil chilling units, meaning that they must be exposed to cold for a certain period of time. Winters must be cold (but not colder than -30°C) to allow for proper dormancy. Dry weather must exist at the time of maturity/harvest. It is important that there should be no sudden and dramatic change in temperatures in spring which kills the flowers. Apricots grown in well drained soils with PH around 6.5



MANGO

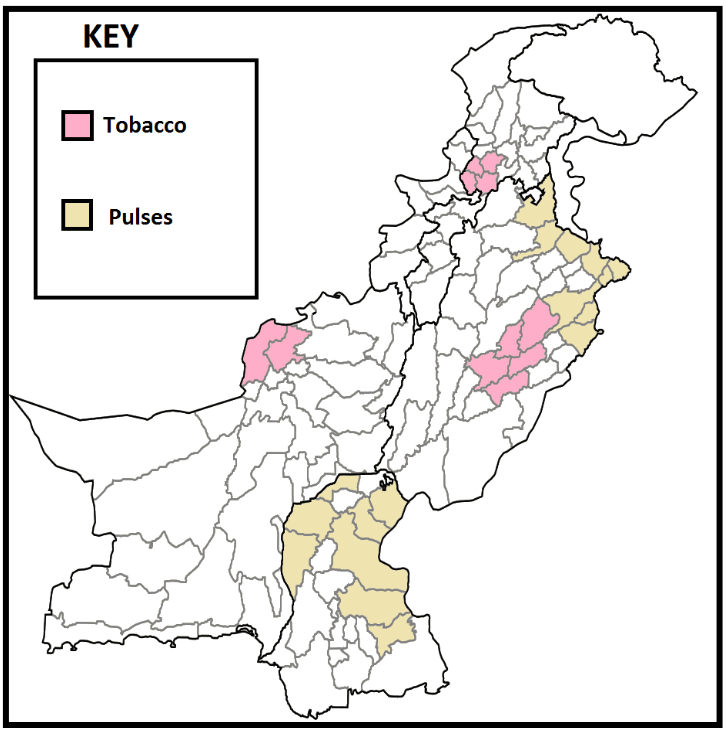
Mango requires a wet hot summer season with rainfall around 250mm. This needs to be followed by a **long dry** winter. Dry winter means that the plant is less susceptible to attacks by fungus etc. It needs deep well drained loamy soil

Mangoes are grown in southeastern Punjab and eastern Sindh

TOBACCO

Tobacco plants are usually first grown in nurseries etc and then transplanted in the fields when the risk of frost has passed. They need light rainfall early on, followed by a period of bright sunshine with rains in between, followed by a dry period at harvest

Tobacco is grown in central parts of Punjab, northern Balochistan and central parts of Khyber-Pakhtunkhwa



PULSES

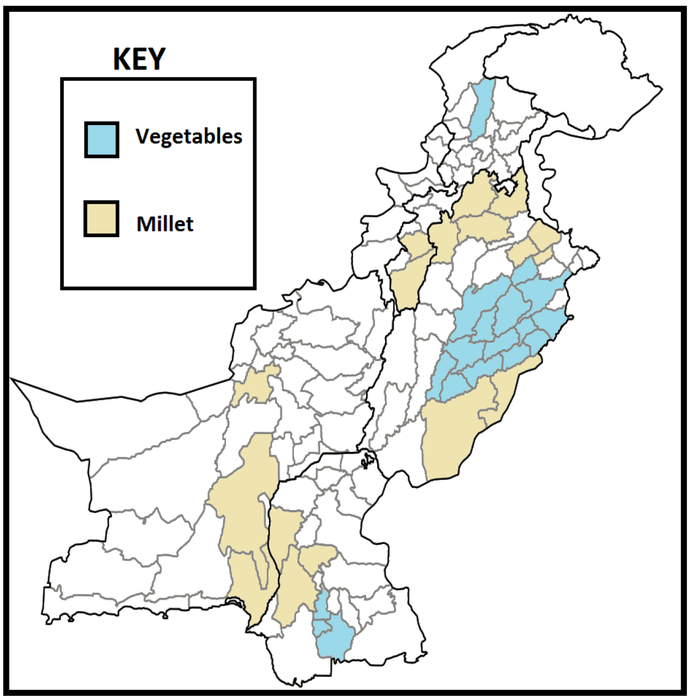
Pulses require high temperatures but are highly susceptible to frost. They can also tolerate high rainfall provided it doesn't come at time of pollination etc. Also the soil must not be waterlogged or saline. Pulses can be grown on sandy, loamy etc soils

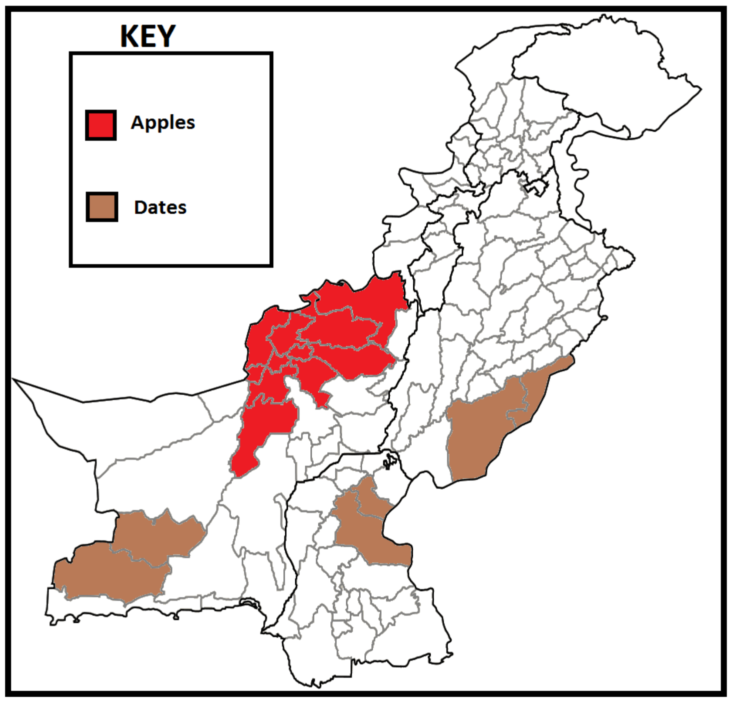
Pulses are grown in eastern and western Sindh, along with north eastern Punjab

DATE PALM

Dates are grown in parts of Balochistan and in parts of Tharparkar desert (southern Punjab and eastern Sindh). It needs long hot summers with high day and night temperatures. It can tolerate fluctuations in temperature whether cold or hot. Mild winters and a dry sunny time for harvest is also required. They can grown in salty soils but they must be well drained

MILLET





Millet requires moderate rainfall and is sensitive to frost. It will not tolerate waterlogged soils or harsh drought.

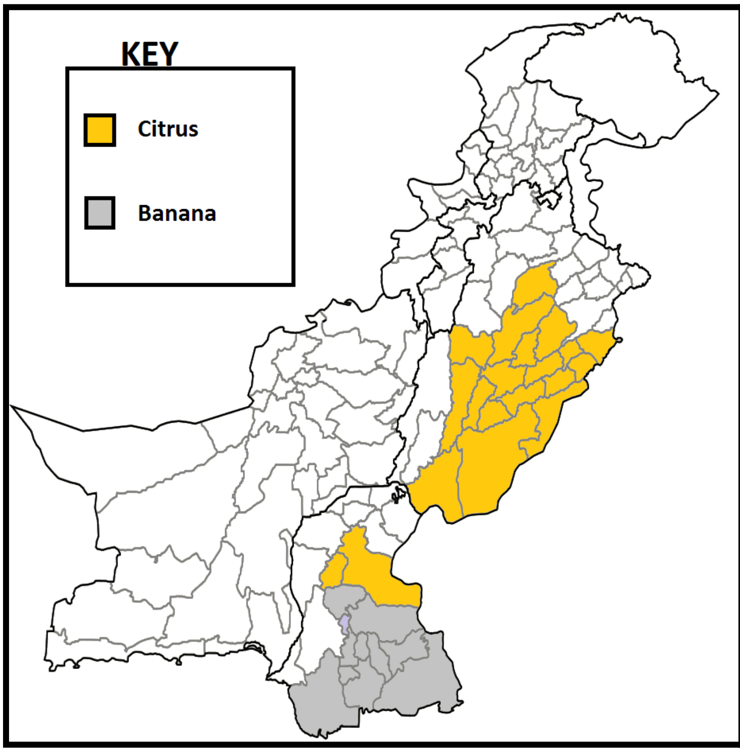
They are grown in southeastern and northwestern Punjab, western Sindh, and central and southeastern Balochistan

APPLES

Apples are solely grown in northern Balochistan. They have the highest requirement of chilling units in fruits. Winters must be cold to allow for proper dormancy. These must be followed by rains during the growing season. Dry weather must exist at the time of harvest. Well drained loamy soils are best for growing apples

CTRUS

They grow in tropical or subtropical climate with hot summers and moderate rainfall. They are also sensitive to frost and strong winds. Most of the production is from Punjab including its central but mostly southern parts. Some citrus production also occurs in eastern parts of Sindh

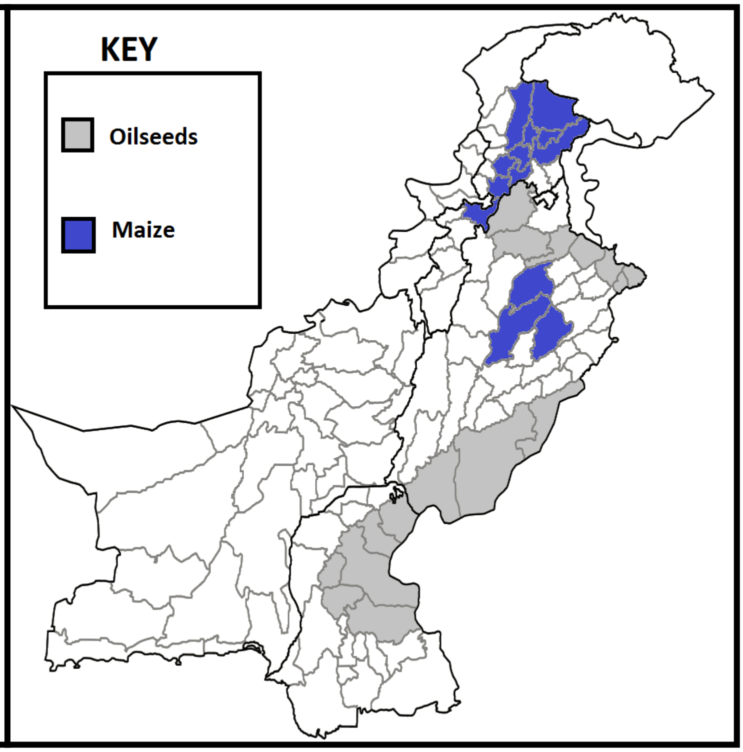


BANANAS

Bananas are grown exclusively in southern Sindh. They require a hot dry season lasting for around 2-3 months, with a mean rainfall of around 10 cm. Bananas are very sensitive to frosts, which can suspend maturity or even kill the plant. They are also very vulnerable to strong winds, which damage the fruit etc. They require well drained alluvial soils

OILSEEDS

Oilseeds usually require average temperatures varying from 20-30°C. It must also be noted that high temperatures can hamper or delay growth and that frost kills the plants. Oilseeds are tolerant to drought for some periods and require well drained deep alluvial soils



They are grown in southern parts of Punjab and eastern parts of Sindh, along with some northern parts of Punjab

MAIZE

Maize needs a hot bright growing season to flourish. It is very intolerant to frost and needs moderate rainfall well distributed throughout growth. It also needs well drained deep alluvial soils

It is grown in central Punjab and central parts of Khyber-Pakhtunkhwa

Fruits are mostly grown in valleys in Balochistan where temperatures are bearable, wind speed is low, soil layer is thick and water from irrigation is available

BARANI FARMING

It is practiced in areas like the Potwar Plateau which have low amounts of **seasonal rainfall**. Important crops grown are wheat, maize, millet etc all which require low amounts of water and sunlight

When the rains arrive or are about to arrive, the land is ploughed so it becomes soft. Immediately after the rain, the seeds are sown and the periodic cycle of sunny weather in between light rainy days continues till the harvest. Within the growing period hoeing is done (to remove weeds), if pesticides and fertilizers are available then they are added otherwise cow dung is used. Lastly the harvest season must be sunny and dry.

FLOOD PLAIN FARMING

Sometimes flood plain farming may also take place (usually in the flood plains of Sulaiman and Kirthar Mountains). The farmers wait for the rains and build bunds around the edge of their fields (nearer to the valley sides). When the rain torrents arrive, they build bunds on the mountain side (so as to trap water between the two bunds). Crops (maize, sorghum etc) are usually planted just before or just after the rains. Any further rain can lead to flooding thus submerging the crop.

Undoubtedly since farms are small (lack of abundant fertile and flat land), traditional farming methods are used (low yielding seeds and little fertilizers). In some years the amount of rainfall can vary greatly. Overall the yields are low

IMPORTANCE OF CROPS TOWARDS PAKISTAN'S SURVIVAL

Most of Pakistan's population lives in rural areas, where the primary occupation is related to farming. Agriculture provides food (wheat being the staple diet) for the ever growing population of Pakistan. Increase in crop yields is required to reduce imports (become self-sufficient) and increase exports

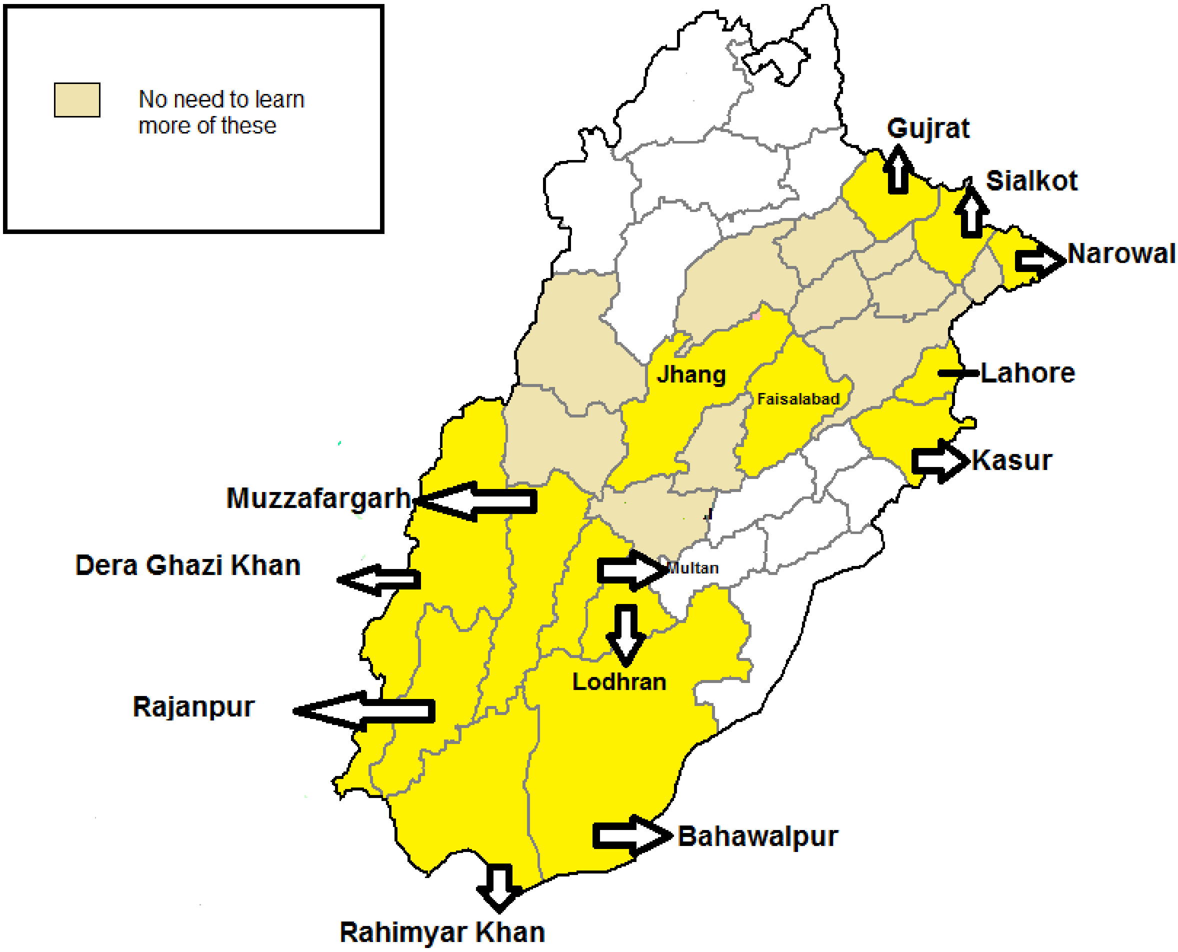
Agriculture also provides a permanent source of income for the many landless peasants **throughout** the year in both summers (Kharif crop) and winters (Rabi crop). The employment guaranteed by this primary sector of employment ensures social stability of the masses. Furthermore, it encourages the growth of agro-based industries like fertilizers etc. Increasing local production of fertilizers means less dependence on expensive foreign imports

Many of Pakistan's industry are agro-based that means they use harvested crops as their raw materials like Cotton Textile Mills utilize

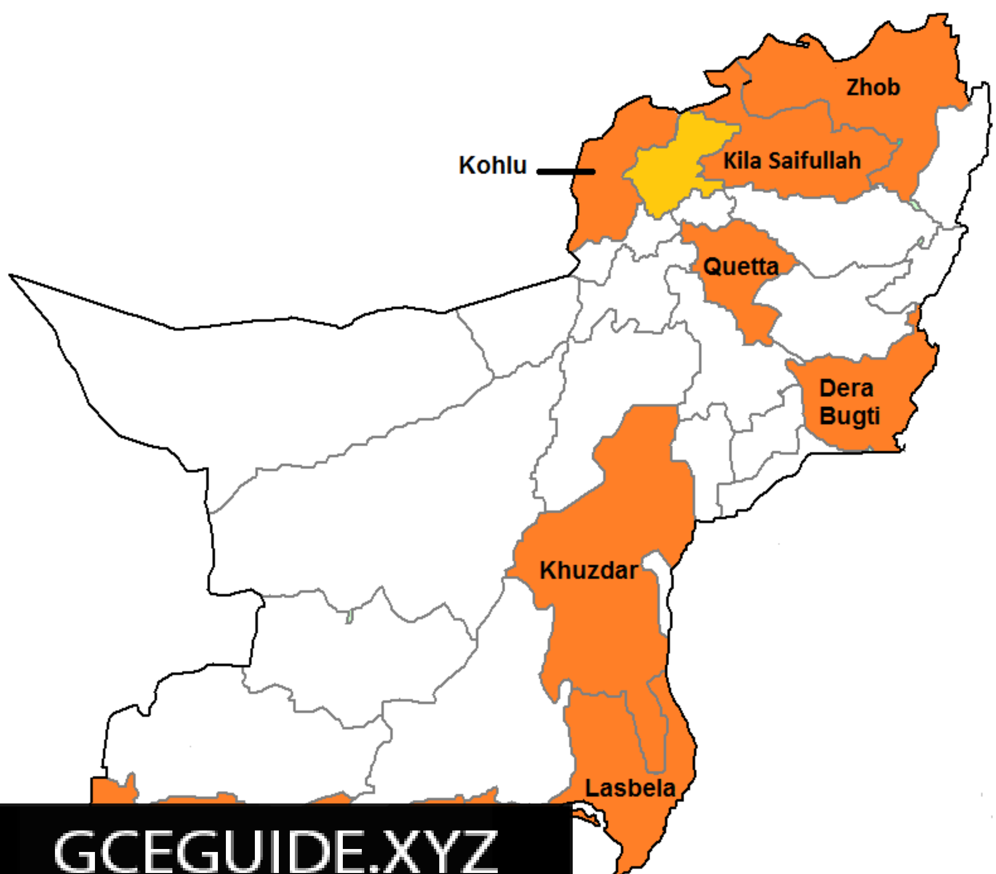
raw cotton, which has been picked from the fields. Export of cotton yarn and garments contribute a significant proportion to the total exports of Pakistan

DISTRICTS TO BE LEARNED FOR BOTH AGRICULTURE AND LIVESTOCK CHAPTERS ARE ON THE NEXT TWO PAGES

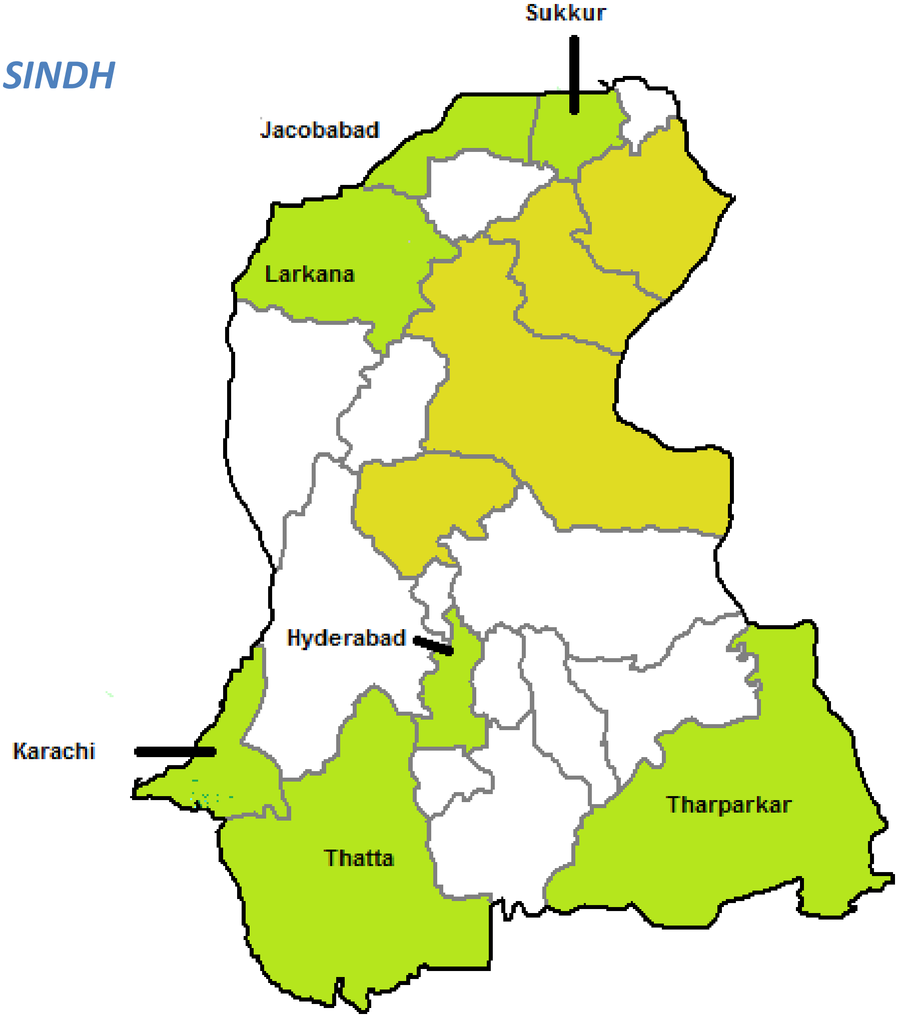
PUNJAB



BALOCHISTAN



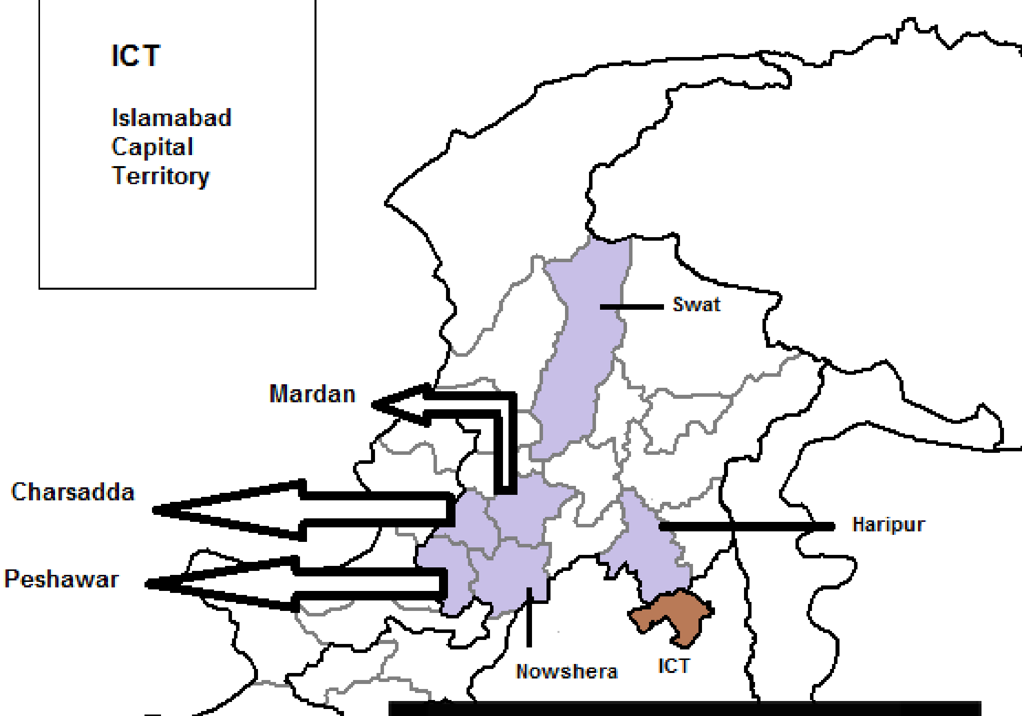
SINDH



ICT

Islamabad
Capital
Territory

KHYBER-PAKHTUNKHWA



LIVESTOCK IN PAKISTAN

9



*Livestock and it's features

*Types of Livestock Famring
Poultry, Subsistence and Dairy Farming

*Problems for Livestock Farming

*Improvements and Potential of Livestock Farming in Pakistan

*Importance of buffaloes, sheeps and goats

Livestock

This type of farming (also known as **pastoral** farming) is concerned with rearing of animals, whose products are then sold. The products include milk and meat of cattle/goats/sheep, and poultry etc. The processes involved are:

- Feeding
- Milking
- Breeding
- Slaughtering

THIS ORDER MUST BE MAINTAINED

❖ OUTPUTS

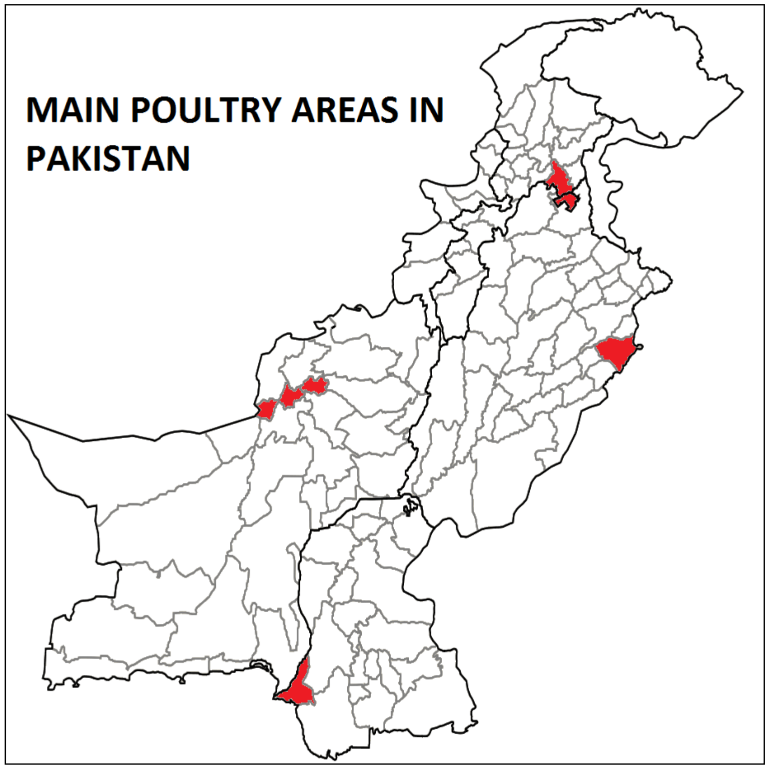
- Milk (Cattle/Goats/Sheep)
- Hides (Cattle and Goat)
- Wool (Sheep)
- Eggs (Poultry)

Livestock farming has three types; **Poultry Farming** (Commercial), **Commercial Livestock** (goats, sheep, but mainly cows and buffaloes). Lastly we have **Subsistence farming, along with the obsolete Nomadic farming**.

If the dairy and meat industry is developed on scientific lines, it will not only meet local demand but will also produce ample quantities for exports

➢ Poultry Farming

Poultry farming is the practice of raising poultry, such as chickens, turkeys, ducks, and geese, as a subcategory of animal husbandry, for the purpose of farming meat or eggs for food.



In Pakistan, most of poultry farming consists of chicken. Poultry farms are mostly found around dense centres of population (Karachi, Quetta, and Lahore) and cooler areas (Murree, Abbottabad). Nearness to population centres reduces cost of transportation and cooler areas are preferred for optimal growth of chickens.

The processes involved in poultry farming are explained below:

- First the poultry farm building is cleaned properly, disinfectant is applied and the building is fumigated.
- Maize is used as food, when the chicks arrive they are given antibiotics in their food for 3-7 days.
- The temperature of the building is maintained between 32 and 37 degree Celsius.
- The chickens are put in cages so their eggs and wastes can be easily removed etc.
- After around 4-8 weeks the chickens can be slaughtered for their meat

Nomadic farming

It is carried out by people living in desert areas of Thar and Kharan. They move place to place with their animals (goats, sheep and camels **only**) and their belongings in search of food and water. Where their animals find land to graze, they settle at that place temporarily so their animals can fatten up. Once the pasture is gone (due to seasonal rainfall accompanied with high rates of evapotranspiration) they start moving again in search of newer pastures. Animals provide milk, meat, hides, bones (for sewing) and can be used as a mode of transport. Nomads are usually found in those areas where crop cultivation and subsistence farming (described below) is impossible due to unfavourable conditions for plant growth. This means that permanent settlement of people at a single place is very rare.

Subsistence farming

In it animals are kept to do daily tasks and provide daily food requirements usually by a subsistence farmer (agriculture one). Animals include chicken, buffalo, cow, sheep and goats albeit on a very small scale. Chicken provide eggs and meat, cows provide milk whereas the **bull (male cow)** is used for ploughing and transport (during planting, growth and harvest of crop). The manure is also used as fertilizer for crops. A pair of two bulls is known as a bullock.

Commercial livestock farming (Dairy Farms)



Cows and buffaloes are raised in an organized manner for commercial purposes. It can be very profitable for small land owners, giving higher returns as compared to traditional farming methods, as land requirements are low. The fodder can be grown on the fields and then fed to dairy animals. The animals are also given a ration of special protein rich diet along with vaccinations to protect from infections etc, which can affect production of milk. If bigger dairy farms are established then the milk can be processed and packed too thus adding value to it. When the cow stops producing milk it is slaughtered along with other bulls for their meat, which is then sold in the market to earn a profit

Dairy farms are important in Pakistan around big cities like Karachi etc. These farms provide milk regularly and cheaply due to the small distances involved. Meat and hides are also provided. Hides are used by leather industry and milk is used to make ghee. Furthermore, the dung can be sold and used in place of firewood etc

PROBLEMS FOR LIVESTOCK, DAIRY AND POULTRY INDUSTRY

- Illegal smuggling of animals from Pakistan to Afghanistan hampers production leading to shortages of able bodied animals. This shortage os supply increases the price of animals in local markets. Also, the price of their products like milk, meat also increases
- Lack of processing facilities like pasteurization renders most of milk unsuitable for consumption after some period of time due to milk's perishable nature
- Transport links must be improved so that milk is transferred from areas of production to areas of demand quickly and thus does not deteriorate when it reaches the market
- Yields of dairy animals can vary thus more focus needs to be showered upon animal husbandry techniques to achieve good reliable yields
- The existing breed of cows and buffalo produce low amount of milk or beef when slaughtered, resulting in low turnover for the owners
- Many dairy animals are susceptible to diseases including malaria. With poor veterinary facilities the yield of animals is fairly low due to weakness. To further compound the problem the animals may die early providing no returns whatsoever
- Monopolization and price fixing mean that the farmer receives a very low percentage of the actual price of the milk which is sold in market. So, the farmer has a very low turnover and he has little money to re-invest in his business to try to improve it

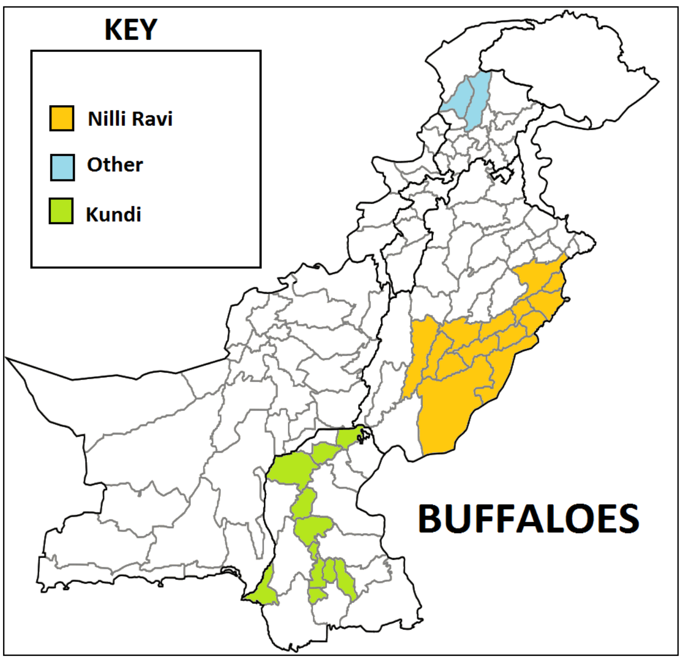
IMPROVEMENTS AND OPPORTUNITIES FOR LIVESTOCK, POULTRY AND DAIRY INDUSTRY

- Vaccination programmes need to be improved so to prevent or reduce cases of diseases, which affect production of milk and beef
- Medicinal and fodder facilities must be improved to increase health and weight of animals
- New varieties of animals must be introduced in Pakistan and hybrid of desi and new variety must be developed, so that the offspring produces higher yields and is also able to survive conditions like high temperatures in Pakistan
- Milk processing facilities must be developed so that value can be added to milk. Also, hygienic conditions must be improved, so exports of milk related products can improve (currently not preferred by foreign customers)
- Hygienic conditions also help maintain health of animals, so the farmer suffers fewer losses due to premature death
- Biogas and electricity generation facilities must be established. Decomposing manure produces methane, which can be burnt to produce electricity. This can be used to power refrigeration and milk processing facilities etc
- Milk collection units must be setup to collect milk from different areas and bring it to one main processing facility
- Machinery can be leased to farmers like tractors. They are used to grow fodder or transport fodder etc, as for a small farmer these are expensive to buy
- Poultry coordination boards should be established at federal as well as provincial level to help stabilize and maintain prices of animal products
- Lack of grading of eggs at farm level doesn't promote the quality of eggs at a price premium. The practice of grading at

producer's level would be encouraged and price on the basis of grades and standards should be regularly collected and disseminated

BUFFALOES (THE BLACK GOLD OF PAKISTAN) AND CATTLE

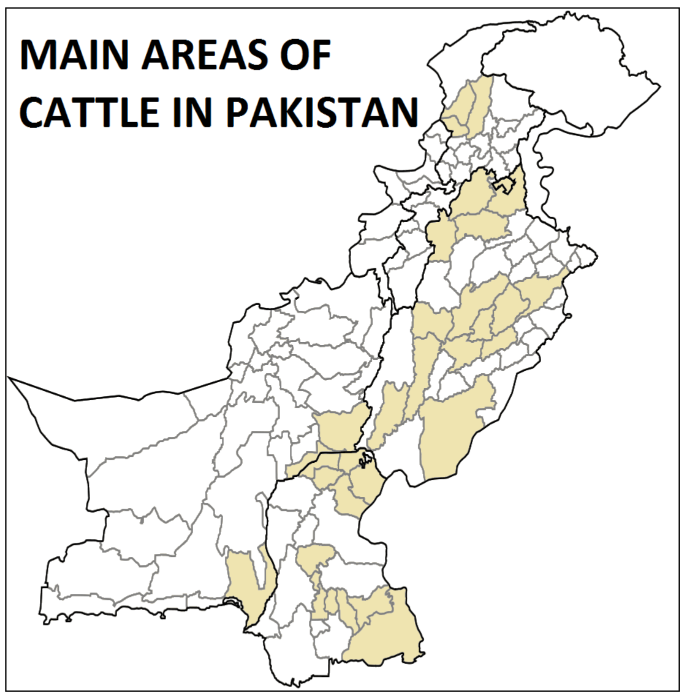
Buffaloes are found mostly in canal fed areas of Pakistan, especially the doab between Ravi and Sutlej. Nilli-Ravi breed is found in Punjab, which is known for its high milk production. In Sindh, Kundi breed is found along both banks of Indus but mostly in Northern and central Sindh. Other breeds are found in areas of Khyber-Pakhtunkhwa



Presence of water is very important as this animal needs to cool itself by smearing mud on its body. Water is also used for drinking and for cleaning the farm etc. A lot of fodder is also required (which becomes expensive to buy in non-agricultural areas) and thus buffaloes are not found in Balochistan as this would be too uneconomical. There are less urban areas there and thus les demand for beef.

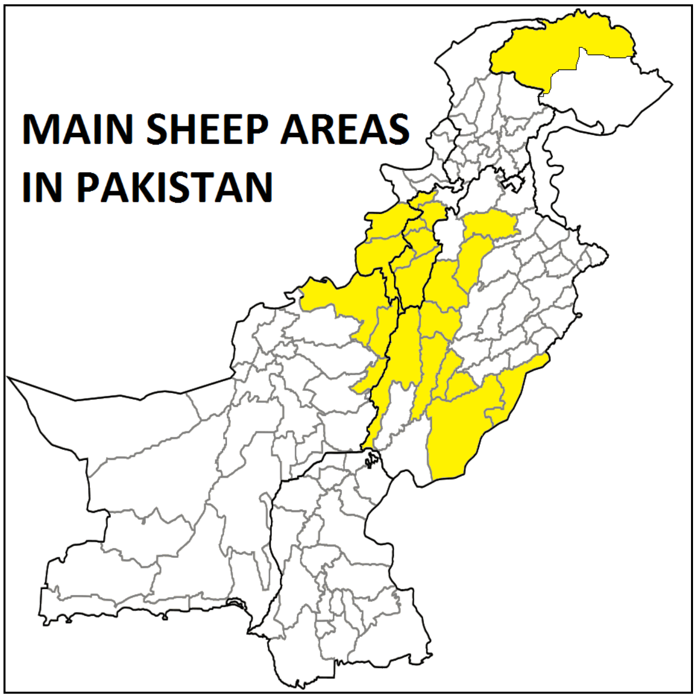
Buffaloes are considered to be black gold of Pakistan because the milk they produce has a higher fat content than that of cows and goats etc. At present, buffaloes provide almost 70% of the milk produced in Pakistan. Also, their meat is white and desirable due to the low cholesterol level as compared to cow's meat

However, it must be noted that still there is ample room for improvement. Pakistan is the 2nd largest buffalo milk producer in the world after India. Also, Pakistan has one of the best breeds for producing milk (like Nilli and Ravi) but due to mismanagement, inefficient marketing system, old livestock technique, exposure to heat, shortage of fodder and late age of maturity mean that this potential is yet to be exploited



Important **cattle** breeds are Red Sindhi and Sahiwali, which are internationally recognized for their milk production. Cattle are spread in Northern, central and Southern Punjab. In Sindh mainly in areas of Tharparkar desert. In Balochistan they are found in district of Hab and in Northcentral parts of Khyber-Pakhtunkhwa

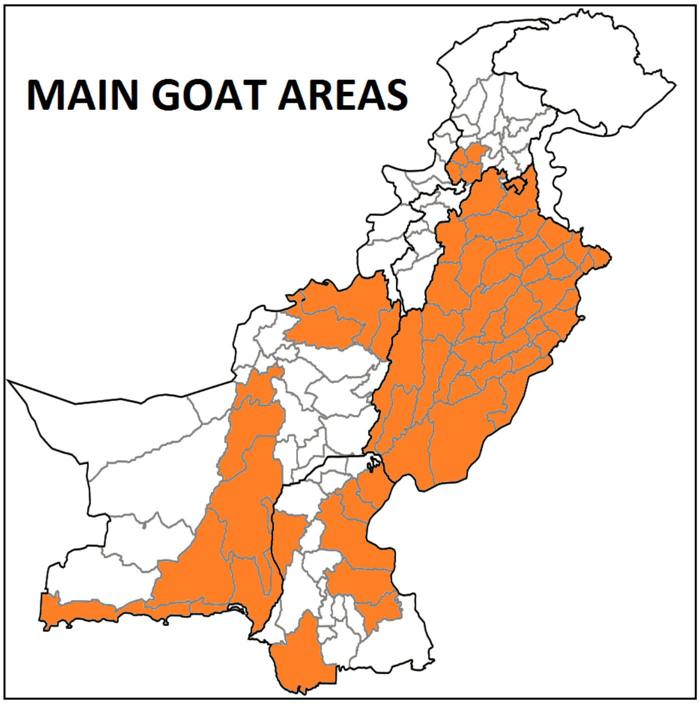
The yield of dairy animals in Pakistan is around 1/5 to 1/7 as to what yields are achieved in Europe and United States of America. If our yields can be improved this can save us from import of milk and related products, which costs around 20 million dollars annually



IMPORTANCE OF SHEEP AND GOATS

Sheep are mostly found in rugged areas of Northern Balochistan, Gilgit-Baltistan, Khyber-Pakhtunkhwa and parts of Southern Punjab. Sheep can survive both hot and cold seasons, and feed on shrubs and grasses. These adaptabilities make them vital for people living in these areas for meat, milk, wool, bones etc

Goats have a much wider distribution than sheep in Pakistan. They are found in almost whole of Punjab, Eastern and Southern Sindh, Makran coast and central Balochistan and districts of Peshawar and Mardan in Khyber-Pakhtunkhwa. Goats are also very adaptable like sheep but since their meat and milk is preferred over sheep; to satisfy this demand they are reared in larger numbers as compared to sheep



On the other hand, the consumption of mutton is also increasing in Pakistan due to increasing population. Much of meat produced in Pakistan is also exported to countries like Saudi Arabia, Oman and UAE.

The demand of wool is also increasing but the wool sector is still very much neglected. Goats

and sheep along with poultry are the backbone of small rural households, which use eggs and meat along with milk for their sustenance. But no real attention is being paid toward this sector; there is no proper system of breeding at organizational level, shortage of fodder and droughts in areas of Balochistan and Sindh means that supplies of fodder are being exhausted. Thus farmers are forced to make sure that their animals survive by grazing a same piece of land again and again. This leads to desertification and subsequent problems of erosion and advancement of sand dunes, which wreck agricultural fields further inland by covering them with sand. To prevent this problem the government encourages the keeping of stall fed goats but due to problems like lack of disease management services, such high density collection of animals is risky

10

INDUSTRY IN PAKISTAN



PICTURE BY AHMED HOSSAIN

*Processes involved in making a good

*Classifications of Industry, their examples and their features

*Advantages and Disadvantages of setting up small/cottage and large scale industries

*Requirements for setting up an industry

*Government policies which help improve industrial output

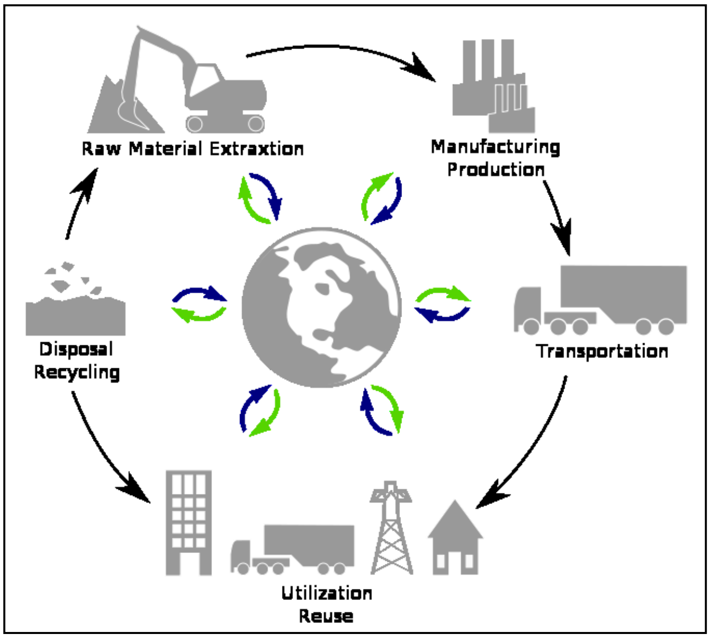
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Fig10.2	**Aymen Rizwan**
Fig10.3	**Fareed Gujjar**
Fig10.5	**Steve Evans**
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Fig 10.9 and 10.10	**Irfan Mirza**
Fig 10.12 and 10.13	**Govt. of Punjab**

➢ INDUSTRY

It is concerned with the whole process of production of manufactured goods. Secondary sector workers form the major building block of industries

Fig10.1



There are basically two types of industries:

Processing

It is the branch of industry that is concerned with the making of formulas and manufacturing recipes

Examples are

- Food and beverages
- Paints and coatings
- Cosmetics
- Pharmaceuticals

Manufacturing

It is the branch of industry that is concerned with using tools and machines to make a product which is to be sold

Examples are

- Construction
- Electronics
- Semiconductor
- Energy industry
- Food processing
- Industrial design
- Metalworking
- Steel production
- Plastics
- Telecommunications
- Clothing industry
- Transportation
- Aerospace manufacturing
- Automotive industry

➢ CLASSIFICATIONS OF INDUSTRY

- **COTTAGE**
  This is a type of industry where 1-5 employees are involved (family members) and fixed assets do not exceed from Rs 1-2 lakh (0.1-0.2 million). They include potter making, furniture, carpet making, embroidery etc. They are labour intensive with little use of machinery. Local skills along with locally available raw materials are utilized

- **SMALL SCALE**
  These are industries which employ 10-50 workers. Their fixed assets don't exceed 10 million rupees. They are labour intensive with limited use of machinery. Some of the raw materials may be brought from nearby cities

- **LARGE SCALE**
  These are industries which employ more than 300 workers (large number of workers) and their fixed assets exceed 100 million rupees (high capital input). They use many machines and the products are produced in large amounts. Land requirements are big too

SUGAR INDUSTRY (Large Scale)

Sugarcane is one of the cash crops in Pakistan. Pakistan's sugarcane production is 5th largest in the world



Fig10.2

Sugar is made from sugarcane. At the time of harvest, the cane is cut and tied in bundles and is quickly transported to sugar mills. This is so, as the sugarcane after being cut starts losing its sugar content and weight.

At the plant, it is first weighed and the farmer is paid accordingly. Then the cane is washed and rocks etc are removed. Then it is passed through rollers to extract the juice. The fibrous thing left behind is known as **bagasse**

Then lime is added into the juice to control pH, lime also stops decay of sucrose. Furthermore, lime also removes impurities by making them clump. The mixture is left like this for some time until impurities settle down at the bottom

Sulphur Dioxide is passed through the juice, which bleaches many colour-forming impurities into colourless ones, so we get white sugar at end. The juice (excluding impurities) is heated to 70°C to evaporate water and increase sugar percentage. This process is repeated until colour changes from thin yellow to dark brown. This syrup is further concentrated under vacuum until it becomes supersaturated, and then seeded with crystalline sugar. On cooling, more sugar crystallizes from the syrup. This thick liquid is spun in a centrifuge to separate the white sugar crystals from the brown syrup. The syrup is returned to the boiling station and boiled again until there is no more sugar left to extract. The extracted sugar is dried and then packed before being shipped.

The remaining product is called **molasses**. It has a low sugar content and further extraction of sugar from it is uneconomic

Bagasse (fibrous material) is often used as a primary fuel source for sugar mills. It produces sufficient heat energy to supply all the needs of a typical sugar mill, with energy to spare which is sold. Bagasse is used to make disposable food containers, replacing materials such as Styrofoam, which is regarded as polluting. Bagasse is also used to make paper and is also made into cattle feed whereby it is mixed with molasses

Molasses (black liquid) is also used for making yeast and spirits. It also relieves constipation etc

The majority of the sugar produced is for local consumption and little is exported

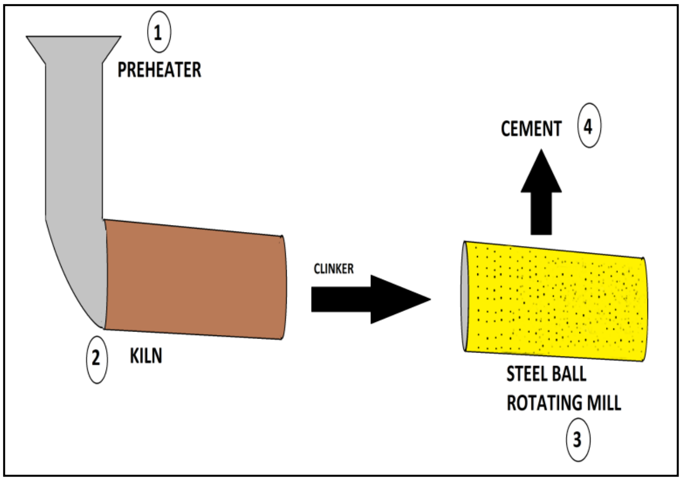
CEMENT INDUSTRY (Large Scale)

Raw materials for making cement are limestone, clay and sand. All of these after quarrying/mining are sent to the cement factories. These factories are located near to limestone sources as to limestone is bulky and expensive to carry over long distances. This increases the per unit cost of production so profits are lowered. Also, accidents can occur as heavy trolleys are difficult to manoeuvre and they also damage the road infrastructure, so to minimize this damage, cement factories are located near limestone sources



Fig10.3

Here the limestone, clay and sand enter a crusher, where their size is reduced to size of a small rock. Then this mixture is analyzed in the labs and adjusted for proper percentage of different components. It is then grinded even finer into powdered form by wheel rollers



It is then sent to pre-heater tower and then kiln. The kiln is a rotating drum which is attached to the pre-heating tower and slopes gently towards the ground. At the end of kiln we have a heat source such as coal or natural gas

1700°C temperatures change the powder into a new substance called clinker, which is in the form of pellets etc. The clinker is then broken down into cement powder. A small amount of gypsum is added to control the rate of setting of cement

Majority of cement produced is for local consumption, although exports are gradually increasing.

Cement is used to make factory walls, build walls of dams, line canals, build homes etc. Furthermore, structures made from cement and bricks are much more robust than structures made from wood etc.

Cement is produced in large amounts in Pakistan because the raw materials required for cement making are found in Pakistan in abundance at a cheap price

COTTON TEXTILE INDUSTRY

(Large Scale)

After picking, the seed cotton is sent to ginning mills, here it is dried to reduce moisture and the dust etc is removed

Then, the lint is separated from the seed by rotating saws, which don't allow the seeds to go through them. The lint is packed into bales, while the seeds are sent to Vegetable and Ghee industries

Samples are taken from lint to assess its quality in terms of fibre length, consistency of length, colour etc; all of these factors determine the price of the bale

The bales are sent to textile mills, where fibres from different bales are twisted and turned (spinning) together by computer controlled machines to achieve uniform thickness of fibre etc. This produces yarn.



Fig10.4

Then different yarns are interlaced to make cloth (weaving) which is also automated. The cloth is then cleaned, immersed in chemicals to enhance finishing (this will come later) and increase its price. Loose threads are also removed

The cloth is then sent for dyeing, where a uniform colour scheme is applied to a length of cloth. After this it is sent for printing, where a series of design schemes are applied onto the cloth



Fig10.5

Sheets, pillow cases, shirts, bed lining etc all are made from this finished cotton cloth

Cotton seeds, upon reaching the Vegetable and Ghee industry are washed and then passed through rollers. Thus, cotton seed oil is expelled leaving behind the cotton seed cake. The oil is used to make cooking oil or margarine etc

The cake is used for dairy animal feed or even as fertilizer for crops

Most of the cotton cloth is exported as it's sufficient to meet local demand. Cotton is only grown in some countries but it is used in many countries for many different products (yarn, cloth etc). Pakistani cotton is of good quality and sells at competitive prices (due to cheap labour employed during picking and processing in the mill etc)

IRON AND STEEL INDUSTRY (Large Scale)

The iron and steel industry requires 5 major components; coke (very pure carbon, which is a very processed form of coal), limestone, iron ore and fuel (mostly coal).

Water (in huge amounts as an input) is used to cool the steel. Manganese (not Magnesium) and Chromite are used to make stainless steel

Coke as well as iron ore are imported from countries like Australia, India and Brazil etc. Manganese is also imported

Coke, limestone and iron ore are put into a blast furnace. Here the intense heat causes decomposition of the limestone. The carbon monoxide gas is produced which reduces iron ore into molten pig iron around 96% pure. After further purification of the iron, carbon and other metals are added to form different types of steel. This is done as iron is much reactive and softer than steel, so iron must be converted to steel

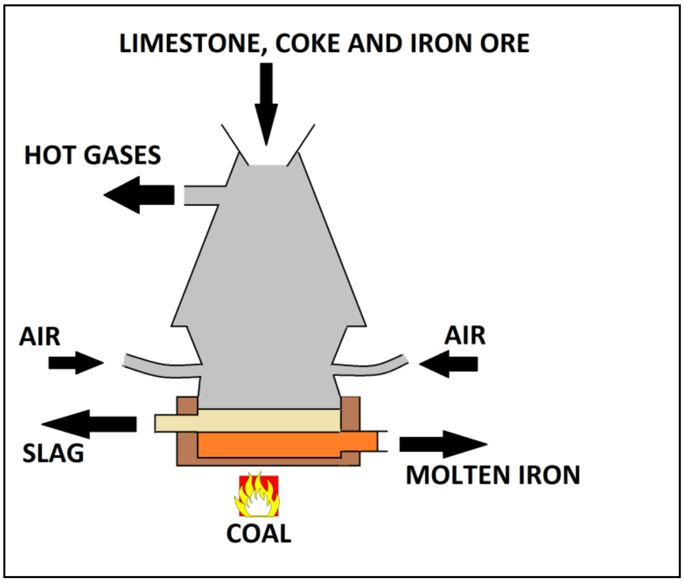


Fig10.6

When the steel solidifies, it is either sent in this form north to cities like Lahore etc. Here we have the Heavy Industry Complex at Taxila, which makes heavy machinery. In Punjab, we have a big and increasing population with increasing demand of steel for buildings, bridges etc

Or at the steel mill it is cast into

- Billets
- Hot and Cold rolled coils/sheets
- Galvanized rolled sheets
- Blooms,
- Ingots
- Slabs

These products are at times exported to countries like China, UAE, Saudi Arabia, Romania, and Bangladesh. Although raw materials for making iron and steel are mostly imported

FERTILIZER INDUSTRY (Large Scale)



Fig10.7

The fertilizer industry basically requires two materials, nitrogen and hydrogen. Phosphorous, Potash etc may also be required

Nitrogen is obtained by liquid distillation of air; meanwhile hydrogen is produced by reacting methane with steam (water). For the purpose of methane supply, fertilizer factories are found close to gas pipelines in Pakistan and near sources of water. These factories are also present near markets, where the demand is high. The distances are small, so transport costs are low, and the demand can be met quickly

Nitrogen and hydrogen are reacted to form ammonia, which is further reacted to form ammonium nitrate, urea, ammonium phosphate etc. Other minerals like phosphorous and calcium are added to have a balanced nutrient requirement for different crops

Fertilizers are imported from Middle East to fulfil the majority of the demand for fertilizer in Pakistan. Most of the factories are located in Punjab to meet the demands of growing population there. Also, a gas pipeline network exists in Punjab.

The use of HYV seeds has meant that to fulfil the increased nutrient requirement of these crops fertilizers must be applied. The flow of the Indus River in the Indus Plains has decreased a lot recently due to dam construction. So the river doesn't flood its banks much often and fresh alluvium is not laid much around its banks. Thus, fertilizers are required to fill the deficiency of minerals left in the soil, as they have been utilized by the previous crop. Desert soils are now being used for growing crops (Thal desert), where the sand dunes have been flattened and canals made. But these desert soils are very porous, so the minerals are quickly leached out of the topsoil. Thus more and more fertilizers are required

In recent years, Pakistan has tried to reduce its fertilizers import so it could reduce its import bill. As a result, Pakistan will have more money to spend on things like education, health etc. Also, local production results in cheaper fertilizers as costs of transport are far lower and that employment is generated in local factories

OIL REFINING INDUSTRY (Large Scale)

Pakistan has 5 major oil refineries. 2 are located at Karachi (Indus Refinery and Pakistan Refinery), 1 in Hab district of Balochistan (Khalifa Coastal Refinery), one in Attock (Attock Oil Refinery) and last but not the least the Mid-Country Oil refinery at Mehmood Kot

Pakistan imports the majority of its oil requirements. They are refined at coastal refineries and sent inland for further processing etc

Oil is refined by heating and boiling all of its components, which are then gradually cooled, the components which have a lower boiling point settle in the top halves of the boiling tower, while the heavier and higher boiling point components settle near the bottom,

Petroleum gas like propane is used for combustion. Naphtha is used to make chemicals and plastics. Petrol is used by automobiles. Kerosene is used as jet fuel. Diesel oil is used as fuel by cars, trucks etc. Lubricating oils are used to make lubricants. Fuel oil is used as fuel by ships and asphalt is used to make roads. Most of crude oil is imported, while very low quantities of refined oil is imported

BRICK INDUSTRY (Small Scale)

To make bricks, raw clay along with 30% sand and water (amount varying due to choice) is put into steel moulds. They are compressed and then put into a brick kiln at around 900°C. The fuel is in Pakistan coal. Most of coal produced in Pakistan is used this way. A series of chemical reactions take place thus changing the chemical structure of the mud and makes it hard

Majority of bricks made are used locally for construction, canal lining etc



Fig10.8

SPORTS GOODS INDUSTRY (Usually small scale but cottage industry too)

Sialkot is the major foci of sport goods production in the world. It accounts for around 40% of world football production accounting for some $200 million exports annually

Raw materials for making footballs are leather, stitches, yarn and glue. Furthermore, things like bats, hockeys etc all are made. These require wood, nails and polish/paint



Fig10.9

However, it must be remembered that due to the problem of child labour many European and American sports brands have stopped orders to Sialkot and Pakistan in general. The problem has been further compounded by the fact that due to loadshedding, many businesses have failed to meet their orders and thus their reputation has been tarnished. This has caused huge financial losses to the industry

Even though most of sports goods production is exported due to modest local demand and high international demand

SURGICAL INSTRUMENTS INDUSTRY (Usually small scale but cottage industry too)

Sialkot also is famous for its surgical instruments, whose export in 2008-2009 was around $250 million. These instruments are made mainly in small workshops which employ many thousands of people. The quality of these instruments is strictly monitored



Fig10.10

However, it must be noted that in western societies there has been a growing concern about the use of child labour (unethical), exploited labour (low wage) and poor worker conditions (poor sanitary conditions, hot environment) in which these instruments are made. This has forced some firms to stop orders from contractors in Pakistan. The raw materials required for making surgical instruments are titanium, iron, chromium and nickel

Most of production is exported due to modest local demand but demand from countries like UK and Germany etc is high

Advantages of setting up a Large Scale Industry

- Employment opportunities for many thousands can be generated, which increases their standard of living and contributes more to the GDP

- Things like steel can be produced locally in large quantities, which is cheaper than imported steel for locals. This can help fuel industrialization (building factories, dam, railways etc)
- Exports can be increased, which increases foreign exchange reserves. They are used to pay off foreign loans, if a country defaults in these payments it could risk a trade embargo from the countries it owes money to
- Foreign dependence on certain goods like iron and steel can be dramatically reduced; allowing for greater independence in foreign affairs. This is because your country would not be influenced by the demands of another country

Disadvantages of setting up a Large Scale Industry

- Air pollution may occur due to exhaust from chimneys and also traffic congestion near the factory may also be of concern. Traffic may consist of trucks brining in raw materials or taking out products and bringing them to markets

- Water pollution may also occur if raw untreated waste is dumped. This will mean that the sewage enters the water table and possibly the human food chain and can cause things like cancer

- Roads may be damaged as they are used more than their capacity with trucks carrying heavy loads most of the time

- Also, lands may be cleared to make new roads and industrial centres. This will result in deforestation and soil erosion

- If industries are set up excessively in urban areas then it may cause rural-urban migration (as government will be diverting funds from development of rural areas towards maintenance of urban areas)

Advantages of setting up a Cottage Industry

- They provide large scale employment to the relatively poor people, who work in the industrial sector. They can also employ rural artisans, women etc
- Also, some farmers can increase their income by learning other skills like pottery, which is a form of cottage industry
- It helps **decrease** regional disparity as the income from these cottage industries is distributed amongst a lot of people
- These industries have few specific requirements (like large amount of capital etc), thus they can be setup by anyone anywhere.
- They are labour intensive and that they can accommodate to a large extent illiterate workers. These workers can be easily trained in a matter of few weeks (unlike doctors etc)
- These industries can produce a significant amount of consumer goods as well as some luxury goods (carpets etc). These goods both compete with large scale industrial manufactured goods. Thus they help reduce the price offered to the final consumer

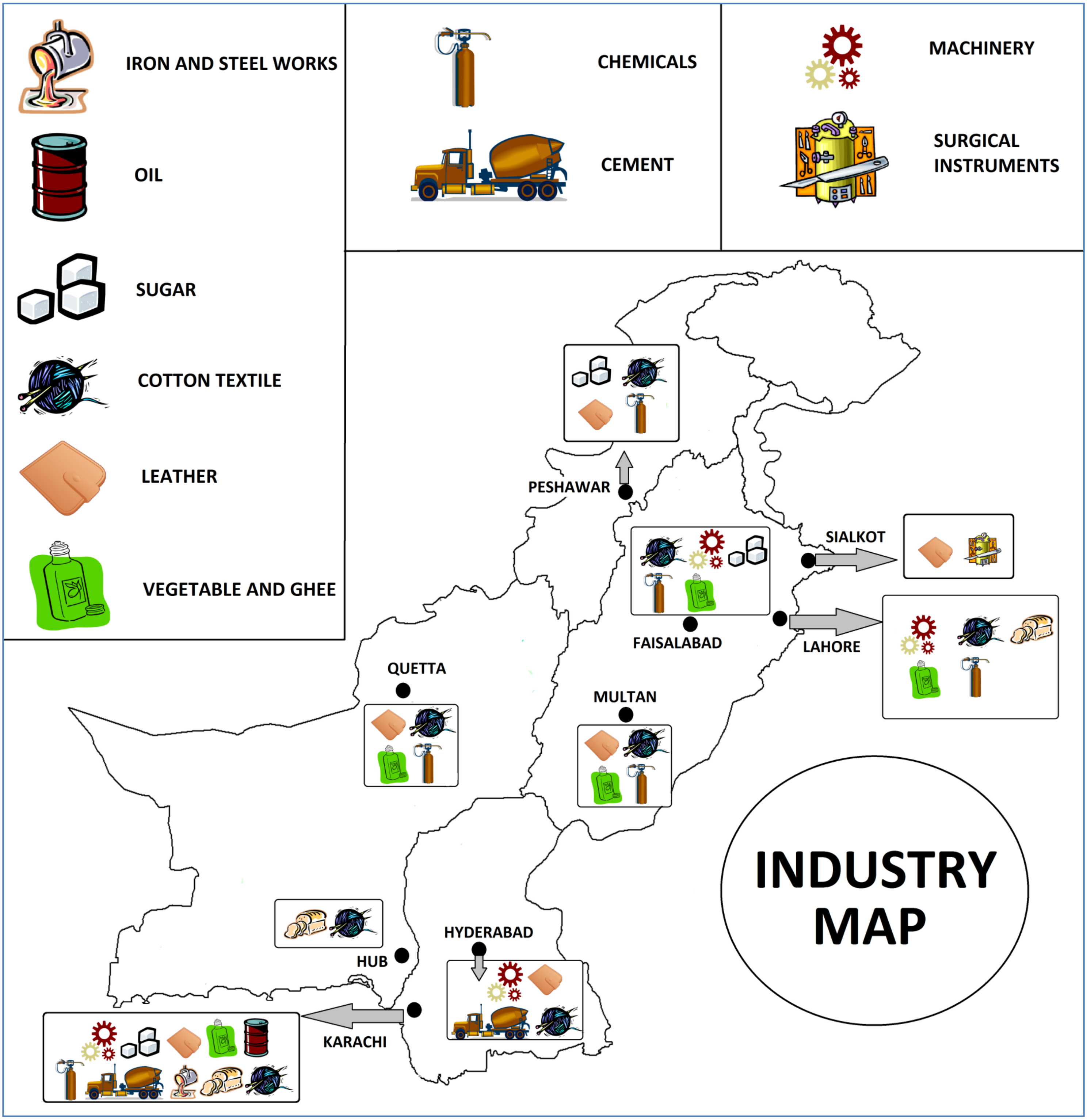
- Furthermore, they also help fill the gap between the supply and demand in the market that might exist for a specific good. Imports can thus be reduced
- Goods that are produced from these industries may also be exported like Pakistani carpets etc; earning foreign exchange
- Setting up of cottage industries utilizes savings thus they are put into circulation as investments, which benefit many people. Also, it encourages small entrepreneurs to take risks etc thus it develops their ability to invest efficiently
- Traditional skills can be preserved and passed to the next generation, thus, maintaining cultural identity
- Eventually these cottage industries help reduce though **not** stop "Rural-Urban Migration". Thus the problems of large, overcrowded cities filled with jobless people can be reduced

Problems faced by Cottage Industries

- Finance management is extremely important for people who set up these cottage industries as their working capital is low. It means that they have less money at their immediate disposal to buy raw materials etc. Financial management requires skill and some financial support from the government
- The goods produced usually do not meet specific quality requirements thus the first batch of goods may be of excellent quality but the following one may be poor. This can result in sudden fall of demand as customers are lost
- Also, the marketing of goods is expensive and is a huge burden on the relatively poor cottage industrialist
- Producers in this sector often purchase goods in small quantities, thus they cannot benefit from the economies of scale, which the big companies enjoy when they buy raw materials in bulk. Thus, the cost of producing a single unit can be high
- The raw materials available in that specific area might be of poor quality, leaving the cottage industry with a dire choice of either using them or facing bankruptcy, as they are too ill-equipped financially to buy raw materials from other areas
- These cottage industries are mostly labour intensive and have little or low reliance on expensive machines. Machines used by large scale industries can produce variety of goods in a short amount of time
- On the other hand, a skilled cottage industry worker takes years to master the art of making a specific object

The advantages and disadvantages of cottage and small scale industries are almost the same, except that small scale industry requires more money to setup etc





IRON AND STEEL WORKS
OIL
SUGAR
COTTON TEXTILE
LEATHER
VEGETABLE AND GHEE
CHEMICALS
CEMENT
MACHINERY
SURGICAL INSTRUMENTS
PESHAWAR
SIALKOT
FAISALABAD
LAHORE
QUETTA
MULTAN
INDUSTRY MAP
HUB
HYDERABAD
KARACHI

Fig10.11

REQUIREMENTS FOR SETTING UP AN INDUSTRY

LOCATION	
Site requirements	Land must be cheap. This will mean that cost of setting up industry will be low and will encourage investors to invest Land must be abundant so if the owners want to expand their existing businesses they can easily do so The land must be well drained so during times of heavy rainfall the factory isn't flooded and production isn't stopped
Transport Infrastructure	Bulky, cheap and quick transport of both raw materials and product is available. This will mean that the per unit cost of making a product and transporting it (to the market) are low. This gives the company a pricing edge over its competitors. This will increase the profits of a company

HUMAN	
Market access	A large demand for goods produced is present nearby. Nearness to the market reduces the cost of transport. If a large market is present, then the company can make bigger profits due to economies of scale The demand is stable and not volatile, so it doesn't vary throughout the year. This means that the company will have sales throughout the year and will have money throughout the year to pay its creditors/ contractors
Raw materials	Stable supply of raw material is present; so the company can order supplies if it faces high demand. This will improve the company's image of a reliable source of products and will help improve sales Large amount of cheap raw material is available near to the factory. Nearness reduces chances of accidents and reduces cost of transport. This will mean that per unit cost of product is low, giving the company a pricing edge over its competitors. This will increase the profits of a company
Labour	A large pool of skilled and unskilled labour is required, which needs little or no further training. This reduces induction costs and time; leading to smoother operations An educated labour force can easily use machines by reading instructions. Also, they use their skills to suggest improvements to work practices. They have the

	necessary skills, which they have learnt from polytechnic institutes. Wage costs are low so that per unit cost of making a product is low, giving the company a pricing edge over its competitors. This will increase the profits of a company **Skilled labour is required to install and operate machines, do managerial work etc. Unskilled labour is required for driving trucks (transporting raw materials and products) etc**
Power	Cheap source of power is available, which means that the per unit cost of making a product is low, giving the company a pricing edge over its competitors. This will increase the profits of a company. The sources of power must be reliable so machines aren't damaged due to sudden spike in voltage etc
Capital	Cheap (interest free loans are the best) sources of capital are available from either the state or private banks. This will allow the business to invest in fixed assets etc. The timeframe for making payments must be wide, so giving a business some breathing space. Loans must be easy to get with no strict conditions for getting a loan, so people are encouraged to invest in their businesses These assets require a lot of capital to set up, but their benefits are long lasting. **They include land, telecommunications, power/gas/water supply** <u>(cleaning, cooling, drinking etc)</u> **and machinery** <u>(cheaper than labour, more accurate, quick and sturdy)</u>
Communication	Cheap communication services must be available. These link the customer and the producer, which is essential to the success of a business
Government Policy	Does the government provide any subsidies etc which are beneficial to an industry? Explained later under "**GOVERNMENT POLICIES**"

GOVERNMENT POLICIES

❖ INDUSTRIAL ESTATES

These are future centres of industry, which are located near major cities. The government actually buys the land and plans the estate. The government builds facilities like railways, roads, electricity, communications etc. A residential area for families of workers is also planned along with schools and hospitals etc. Access to a dry port may also be provided

Cheap loans are also provided for people to invest. For this very purpose the government invites people to invest through advertisements etc. Investors then make 20-30% payment of plots etc (getting control of

land in return). The government then starts construction of the industrial estate. This procedure can take around 2-4 years

Advantages of Industrial Estates

- The concentration of high pressure gas pipelines, sewage lines, water pipes etc; which satisfy demands of industry reduces the overall cost of laying down infrastructure
- Tax holidays and concessions are granted by the government which tremendously help industries as they have more money to re-invest in their businesses. This also means that government can provide these benefits to businesses located in a not so developed area. This will provide employment and generally raise standard of living of people there. Thus regional disparity is reduced
- Also, separate areas are assigned for industries. These don't overlap with residential areas, thus, environmental impact of pollution from these industries is reduced

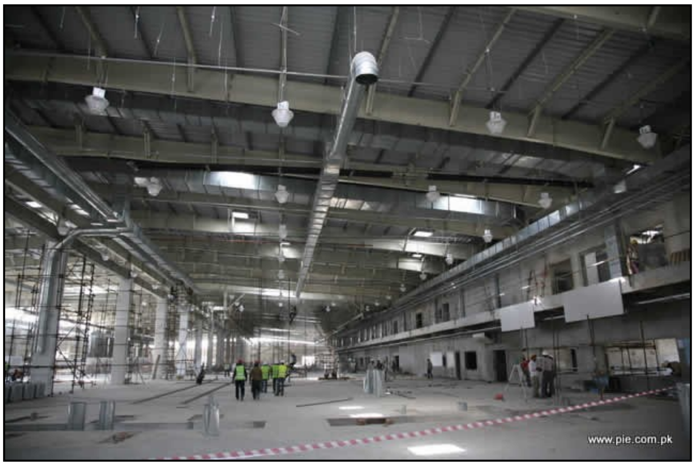




Fig 10.12 and 10.13

List of Industrial estates in Pakistan

- Karachi
- Lahore
- Gujranwala
- Jhelum
- Gujrat
- Hyderabad
- Peshawar
- Chakwal
- Daska etc

❖ EXPORT PROCESSING ZONES

These are places where goods are produced only for exports. There is no tax on imports and exports. Thus trade barriers like quotas and tariffs are all eliminated. High quality standard of goods are maintained **(essential)**

The government builds the entire infrastructure like roads, railways, electricity, gas and water etc

Advantages of Export Processing Zones

- Exports increase significantly; helping to pay off debts and reduce burden of loans etc
- Technology is brought to a country as foreign investors invest in the country. This means that local workforce is trained to use latest machines and learns new skills and techniques which increase production
- Employment is generated which raises the standard of living and reduces regional disparity
- For the workers it is also better as working conditions (pay, working hours) are good. This is required by international trading partners under labour laws etc
- Furthermore, the government can help in advertisement of the products, which are shown off during international trade exhibitions

List of EPZs in Pakistan

- Karachi
- Risalpur
- Sialkot
- Gujranwala

❖ SPECIAL INDUSTRIAL ZONES

Special industrial zones are specific areas which the government outlines as special zones. They are located in undeveloped areas. Here, the government does not develop any infrastructure but serves as the intermediate between infrastructure developing companies and SEZ companies. The government gives huge tax benefits to SEZ companies who invest there. For example a 5 year no tax agreement can be granted

The SEZ companies develop their own infrastructure by contracts with infrastructure developing companies. This infrastructure is also used by the local people. Thus, employment and a better living standard is guaranteed

List of SEZs in Pakistan

- Pindi Bhattian, Punjab
- Hyderabad, Punjab
- Hattar, Khyber-Pakhtunkhwa

- **STABLE GOVERNMENT POLICIES OVER A DECENT PERIOD OF TIME**
- **DRY PORTS (discussed in the Transport chapter)**
- **INTEREST FREE OR LOW INTEREST BANK LOANS ALONG WITH LITTLE CORPORATE TAX**

All help in attracting foreign businessmen to invest in Pakistan

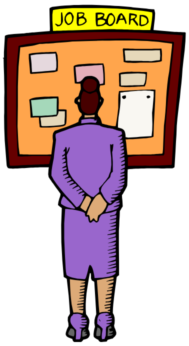
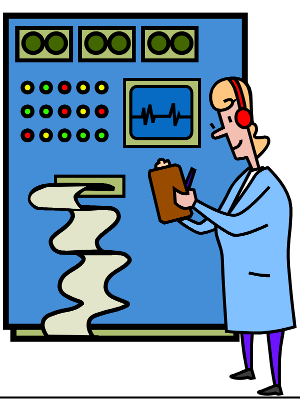
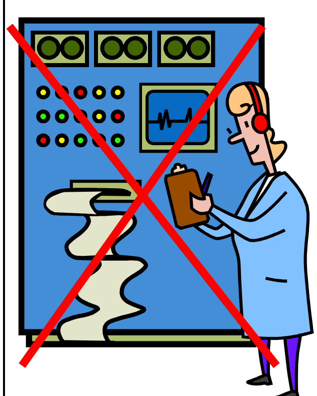
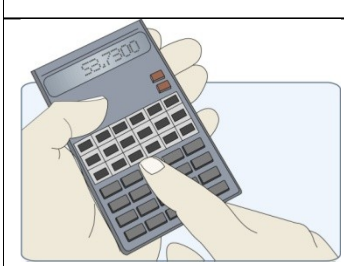
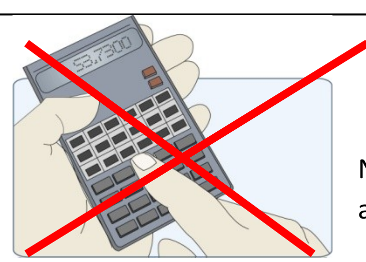
SECTORS OF INDUSTRY

FORMAL

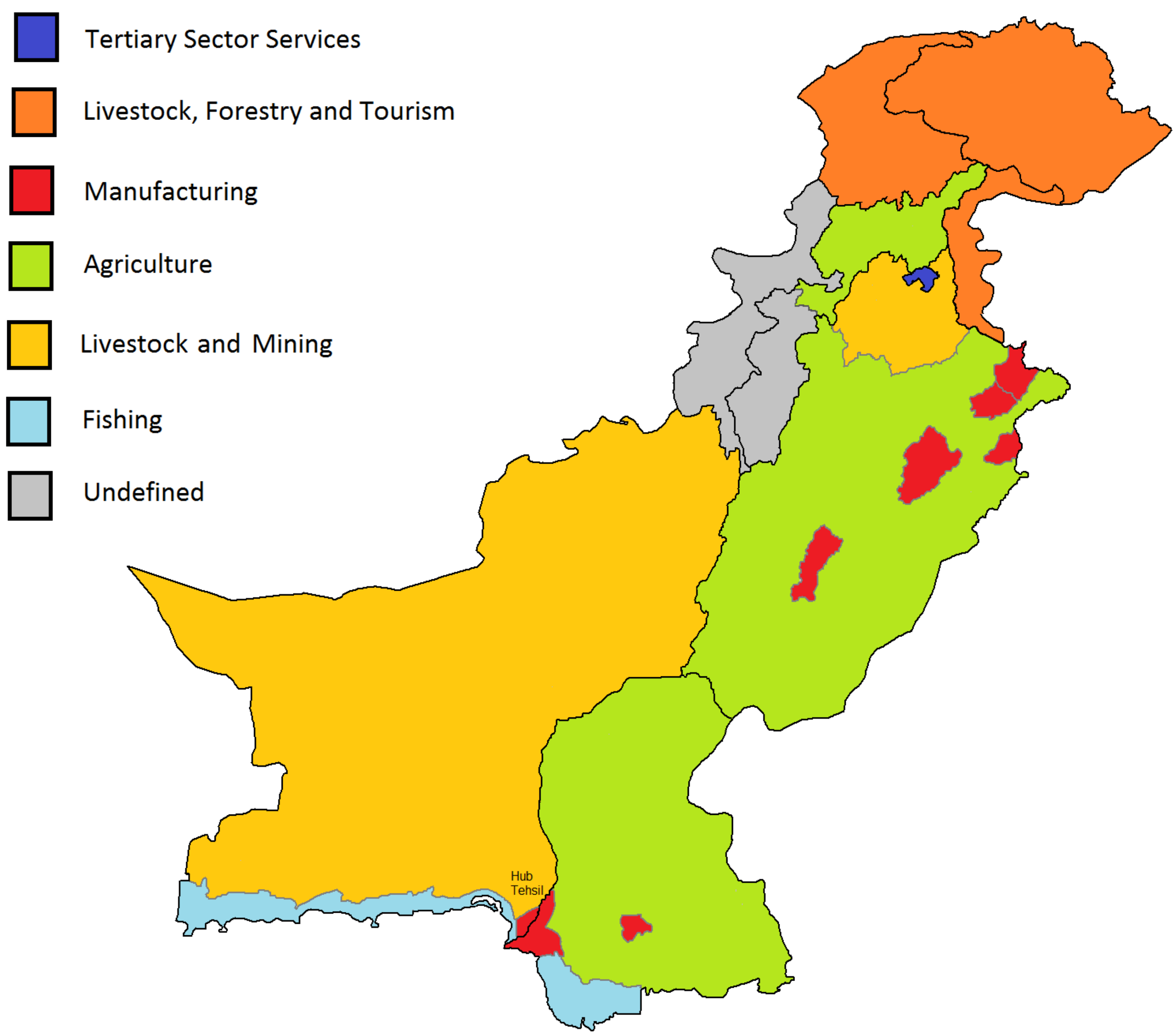
The people involved in this sector are employees of the government or a firm (not self-employed). They have regular pays and working hours are fixed. Also, the business is legally registered and contributes to the GDP. Goods of a specific quality are produced by skilled workers who operate machines. Quality of the goods is monitored and maintained. A proper work area (a building is used). Services like pension scheme/ health and insurance benefits may also be available

INFORMAL

The people are self-employed workers. Their monthly income is variable. Working hours aren't fixed. The business isn't registered with the government tax departments. Goods are sometimes not consistent in terms of quality (sometimes good and sometimes bad). These workers are usually unskilled (don't used machinery) and thus can work on streets and in their homes as well (they utilize their manual skills) etc. There are no pension schemes/ health and insurance benefits

FORMAL	INFORMAL
  Regular Pay	  Irregular Earning
 Employed by an employee	 Self Employee
Quality of goods is maintained 	No standard quality of goods 
  Regular Working hours	  Irregular Working hours
 Tax payments and pension schemes along with insurance benefits	 No taxes paid, no insurance and pension schemes

THE MOST IMPORTANT SECTOR OF ECONOMY -BY REGION



TRADE OF PAKISTAN

11



*Differences between National and International Trade

*Reasons for Increase in World Trade

*Barriers of Trade

*Exchange Rates

*Balance of Trade and Balance of Payments

*Trends in Imports and Exports

*Problems of Trade for Pakistan

*Trade Routes

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ACKNOWLEDGEMENTS

Fig11.1	**Ismail Sultan**
Fig11.2	**Sarfraz Hayat**

TRADE

Trade is the exchange of capital, goods, and services across international borders. It has two types; domestic and international. International trade contributes significantly to gross domestic product (GDP) of many countries

DIFFERENCES BETWEEN NATIONAL (DOMESTIC) AND INTERNATIONAL TRADE

International trade takes place between two different countries as opposed to domestic trade (which takes place inside the country). In international trade there are different currencies, weight systems, type of transport used and higher quantity of goods are traded to achieve economies of scale, as opposed to domestic trade

IMPORT AND EXPORT

Imports are **goods and services** which one country buys from another, so foreign exchange leaves the country. Meanwhile, exports are **goods and services** which one country sells to another thus earning foreign exchange

REASONS FOR INCREASE IN WORLD TRADE

- Industrialization has increased meaning that now a surplus of goods is produced, which is exported after fulfilling the local demand
- Increased communication facilities mean that people in different countries can come into contact with each other, thus linking the producer with the consumer
- Better transport facilities mean that perishable items can be stored for longer and then delivered quickly by air over long distances. Thus even far away producers and consumers are able to trade
- World Trade Organization has been set up. Its function is to open up trade between different countries by limiting or reducing barriers of trade. It also supervises international trade so that it is fair for all
- International Monetary Fund IMF and other such organizations like the World Bank, help in loans etc which prevent a country from running out of cash over short periods, although these must be repaid
- Trading blocs have been setup like SAARC (South Asian Association for Regional Cooperation), which are intergovernmental agreements in which regional barriers of trade are reduced or eliminated

BARRIERS OF TRADE

- Import bans, in which certain goods are banned from being imported or exported like state secrets
- General or product-specific quotas, this mean that once a certain number of goods or certain value of goods enter/leave the country and a threshold is reached, further import or export is prohibited
- Rules of Origin and Delivery, in which a good must only originate from a specific list of countries or exported to specific countries,

otherwise it wouldn't be imported or exported

- Quality conditions imposed by the importing country on the exporting countries, which means that a good must be produced with certain quality standards like hygiene, no child labour etc, otherwise it wouldn't be imported
- Import licenses, in which importer must seek government license before they import certain goods like ammunition
- Export subsidies, in which the government actually reduces taxes on exporters. This makes it easy to export and send goods to other countries. But the problem is that other countries don't want their local production to suffer a loss in market share to cheaper foreign goods, as customers will buy cheaper foreign goods then. This will mean little sale of domestically produced goods leading to low profits, shutting down of factories and thus unemployment
- Intellectual property laws (patents, copyrights). This means that certain goods can't be traded without permission from the company/person to whom the intellectual property belongs like designs of complex building, researches etc
- Lengthy customs procedures in which an exporter's goods will face lengthy checks thus he won't be able to deliver his goods to the customer on time and will result in loss as he won't be paid
- Taxes like import tariffs which make it harder and expensive to import goods. Along with export tariffs which make it expensive to export as to prevent export of goods which are already deficient in the local market but have high international demand

BALANCE OF TRADE AND BALANCE OF PAYMENTS

Balance of trade is the difference between visible imports and visible exports. A negative balance of trade means more goods are imported than exported

Balance of payments is the difference between (visible and invisible imports) and (visible and invisible exports). Here invisible imports/exports are services like professional Pakistanis who work in the Middle East. They are an invisible export as they will be sending money back to Pakistan in form of remittances, which increase the foreign exchange of Pakistan

WAYS OF EARNING FOREIGN EXCHANGE

- Hidden earnings
- Remittances
- Export of goods

MAIN ITEMS IMPORTED BY PAKISTAN	2003	2004	2005
Machinery and transport equipments	$4,210,987,000	$4,851,710,000	$7,385,403,000
Chemicals and related products	$2,790,406,000	$3,330,996,000	$4,090,742,000
Mineral fuels	$3,319,013,000	$3,903,106,000	$5,299,088,000
Inedible Crude Materials[- except fuels	$1,382,605,000	$1,560,549,000	$1,886,312,000
Coal and Coke	$147,095,000	$190,971,000	$268,950,000
Petrol and related products	$3,157,810,000	$3,691,559,000	$5,011,579,000
Iron and Steel	$510,653,000	$645,314,000	$1,215,991,000
Machinery specialized for particular industry	$961,512,000	$961,512,000	$1,720,608,000
Telecommunication and sound related equipments	$478,765,000	$574,916,000	$1,793,132,000
Road Vehicles	$650,787,000	$743,493,000	$1,397,934,000

MAIN ITEMS EXPORTED BY PAKISTAN	2003	2004	2005
Cereals and cereal preparation	$687,842,000	$739,791,000	$1,213,087,000
Textile yarn, fabric and related products	$6,030,136,000	$6,124,587,000	$7,087,465,000
Clothing accessories	$2,840,412,000	$3,025,735,000	$1,546,040,000
Food and live animals	$1,177,971,000	$1,215,865,000	$1,645,221,000
Baby carriages, toys, games and sporting goods	$324,298,000	$315,876,000	$317,528,000

BALANCE OF PAYMENTS OF PAKISTAN	2008	2009
IMPORTS	$38.22 billion	$28.47 billion
EXPORTS	$21.22 billion	$18.44 billion

Courtesy of WTO

IMPORT TRENDS

In recent years, Pakistan's imports have relatively been in increase till 2009, when the recession struck hard and imports dropped by a near 10 billion dollars. Generally demands for equipment like machinery is generally increases as the country moves away from an economy mostly dependent upon agriculture to a more industrialized economy. Machines are needed to run factories etc. Also, this shows that local supply of machines is not sufficient either the technology to make them doesn't exist or even if it does machines are manufactured locally on a small scale.

Demand for transport equipment like cars is also increasing due to increasing population and a growing middle class who can afford them. Tractors are required for fields, and in agriculture we see a shift from traditional methods of farming to a more productive mechanized method of farming

Demand for chemicals like pesticides and fertilizers is also increasing due to the building of dams, no more silt reaches the crop growing areas as chances of floods are reduced. These floods left behind a fresh layer of fertile soil behind. Since more areas are brought under cultivation to meet demand local demand, more fertilizers are required to increases yields and reduce imports of crop and related products

Demand for petrol and related products are also on the rise due to increasing population and demand of automobiles etc. The costs of petrol and related products has also jumped because of the tensions in the main oil producing regions like Middle East, which leads to uncertainty about security of future supplies. This means that many countries start to store oil related products thus increasing demand while supply remains relatively stable. Power generation needs a lot of oil too. Demand for coal has also increased because steel furnaces and cement factories cannot use local coal. The local coal is not of adequate quality as processing techniques aren't implemented

Demand for iron and steel products has also increased because of increased development of buildings, dams

Import of wheat is required some years due to inconsistent production of grain (caused by inefficient support prices of wheat, so farmers plant other cash crops more and less wheat). Wheat is imported from Russia, Australia and USA to feed a growing population

EXPORT TRENDS

Generally Pakistan's exports have risen but not in pace with imports. This means that a negative balance of payment occurs, which will be discussed in depth later.

The export of cotton and related products is steadily increasing as more land is brought under cotton cultivation. Also, due to increasing use of pesticides and fertilizers yields have increased thus more surpluses are available for export. Rapid industrialization has meant that more cotton is processed into yarn and cloth rather than sold as raw cotton. This is adding value to a good, which means that this piece of cloth fetches more and gives more profit than if it would have fetched had it been sold as raw cotton

Exports of wheat have also increased although it fluctuates a lot. Export of rice is also on the increase due to use of fertilizers, pesticides, high yielding varieties of seeds etc. Export of animal and related products has increased to the Middle East due to preference for Halal meat

Export of sports goods and surgical instruments has been disappointing as the rate of increase is very low. Although these industries have been established for a long time at Sialkot, the fact that most of them use child labour, their products have been banned from import in USA and Europe, two major markets. Also tough competition from countries like China and Vietnam mean that urgent steps need to be taken to secure jobs in this industry

PROBLEMS OF TRADE FOR PAKISTAN

Pakistan has a developing economy but it faces major hurdles which include:

- Dependence of major exports on a few commodities. Most of Pakistan's exports are agro-based and when yields are low due to floods etc (or attacks by leaf curl virus on cotton crop); exports plummet. Exports therefore need to be diversified so as to ensure consistent value of exports per annum
- Power cuts are back breaking to industries as they halt production, thus orders can't be fulfilled leading to loss of market share in other countries. Foreign customers as well as local customers are lost
- Less people willing to invest in Pakistan due to economic and social instability which means that there is no influx of technology or foreign reserves in the country
- Devaluation of the currency makes importing of machines etc difficult. This hampers further the modernization of industry
- The problem of child labour has led to decrease in orders from Europe and USA for sports goods and surgical instruments
- Import tariffs by EU countries on Pakistani textiles to protect their own cotton industry means that Pakistani cotton is expensive to buy there. Exports are not very profitable thus exports have decreased
- Remittances haven't increased a lot in the last 2-3 years meaning that it is difficult to find foreign exchange to pay for increased imports
- Fish related industry is also suffering due to lack of quality control procedures during processing of fish, which means it can't be exported to the West
- Fruit related industry can't export fruits to far off places due to poor methods of preservation used. Most of the fruit becomes unfit for human consumption and is thus wasted
- All of this results in a negative balance of trade, thus Pakistan has less money to spend on education, health services or in development of oil/gas fields or industries etc. Taxes are increased and thus goods are expensive, so people buy less and GDP falls

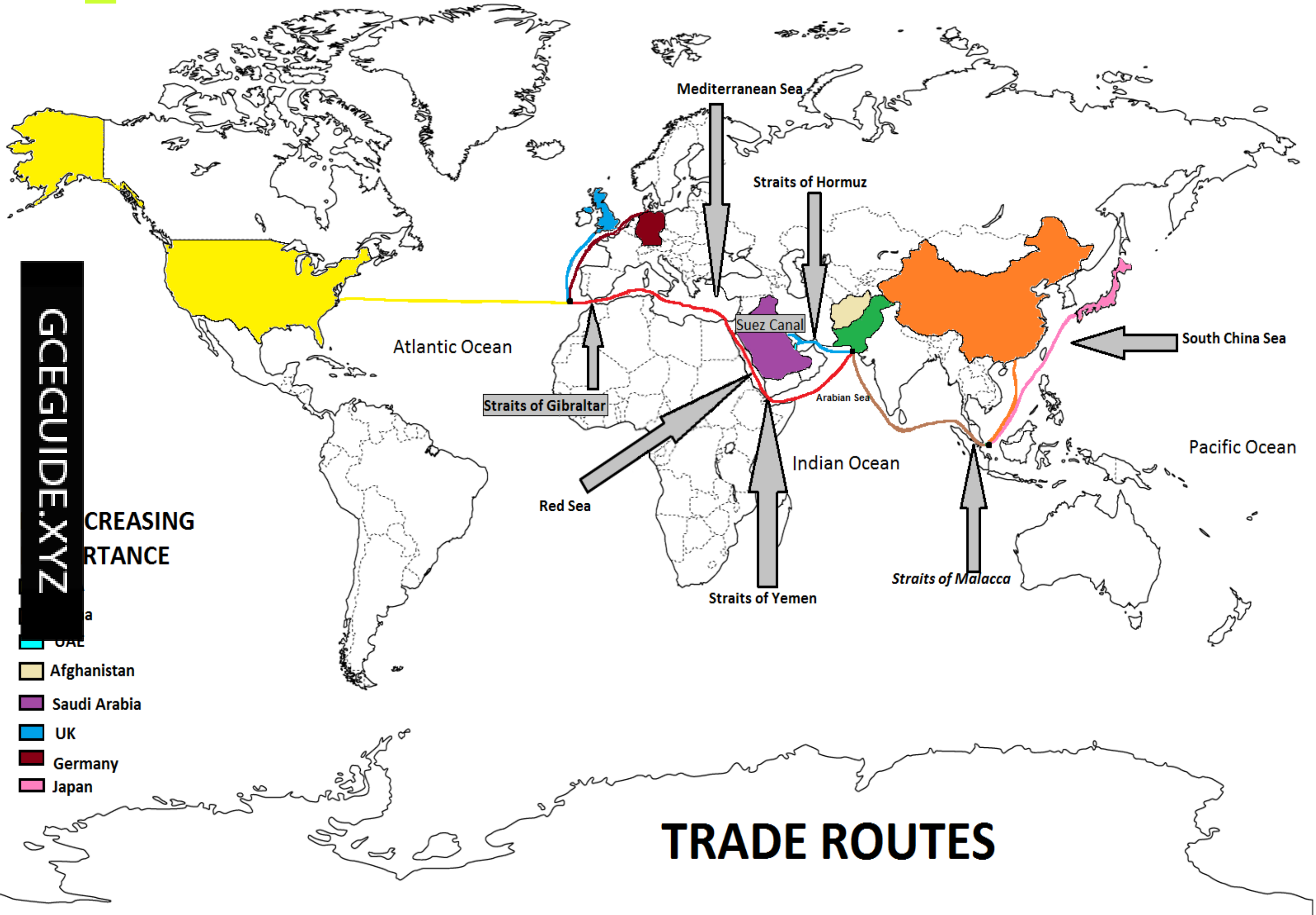
EFFECTS OF NEGATIVE BALANCE OF PAYMENTS ON ECONOMY

A negative balance of payments means that Pakistan needs to urgently raise money to pay for its excess imports. This means that big loans must be taken out from IMF and World Bank. Since these loans come with high interest rates, the government needs to raise taxes to pay them back. This means that prices of goods increase in the local market. People's real income decrease as they are able to buy fewer goods. This results in low demand for locally produced goods, which lowers profits for industries and results in loss. Workers need to be laid off to reduce costs. This increases unemployment and

increases social disorder thus hampering foreign investment

People are unwilling to invest and move their businesses out of the country, which means that no modernization of influx of new ideas occurs. Production is lowered and cost of production increases, this makes locally produced goods uncompetitive in foreign markets leading to slump in exports and ultimately default on loan payments. This means that you can have your country's foreign assets and funds frozen and an embargo placed on your goods in international markets

Furthermore, money is diverted from projects which aim to improve healthcare, education etc. The living standards of people fall and there is general discontent within the general population


TRADE ROUTES
Mediterranean Sea
Straits of Hormuz
Suez Canal
South China Sea
Atlantic Ocean
Straits of Gibraltar
Arabian Sea
Red Sea
Indian Ocean
Pacific Ocean
Straits of Yemen
Straits of Malacca
CREASING
RTANCE
Afghanistan
Saudi Arabia
UK
Germany
Japan

TRADE ROUTES

SEA

Europe and USA

For Europe and the **USA (United States of America,** don't write America only) shipping vessels start from ports in the Arabian Sea. From there they move South into the Indian Ocean and then pass West into the Straits if Yemen into the Red Sea. They cross the Red Sea and pass into the Mediterranean Sea via the Suez Canal. They move Westwards through the Mediterranean and into the Atlantic Ocean via the Straits of Gibraltar

Vessels who have to move towards USA continue on their Westward course and then reach the East coast of USA, while the ships who have to go to Germany or UK move North after passing through Straits of Gibraltar. Some ships which need to get to Germany pass through Straits of Dover between France and the UK

East Asia

For East Asia (China and Japan), ships start from the Arabian Sea and move South towards the Indian Ocean. From there they move East around Sri Lanka and move East. They move through Straits of Malacca thus emerging into the South China Sea. Then they move north towards either China or move a bit further east towards Japan in the Pacific Ocean

Persian Gulf

For Persian Gulf, ships start from the Arabian Sea and move West immediately towards Straits of Hormuz and enter into the Persian Gulf. From there on they move either to UAE or a bit further West towards Saudi Arabia

LAND

China

Karakoram Highway connects China and Pakistan across the Karakoram mountain range, through the Khunjerab Pass, at an altitude of 15,397 ft

Afghanistan

Pakistan is connected to Afghanistan by Chaman pass in Balochistan and Khyber Pass in Khyber-Pakhtunkhwa

SEA PORTS OF PAKISTAN

Pakistan has 3 main deep sea ports

- ### Port of Karachi

The Port of Karachi is country's **largest and busiest seaport**, handling about 60% of the nation's cargo (25 million tons per annum). It has 30 berths and 2 wharfs (explained at the end of chapter)

- ### Port Bin Qasim

It is country's 2nd busiest seaport. In the 1970's it was decided that the country's first steel mill be built near Karachi. A purpose-built specialized port facility was also decided to be established for bulk handling of the massive imports of raw materials for steel production by the Pakistan Steel Mill at Pipri

In addition to the future economic demands and strategic needs, this port was also meant to relieve congestion at the only seaport the "Karachi Port". Port Bin Qasim was located here because of the abundant flat land that was available and because it has sheltered a harbour (which limits the deposition of sand and silt, if that happens expensive dredging may be required to re-deepen the waterways again)

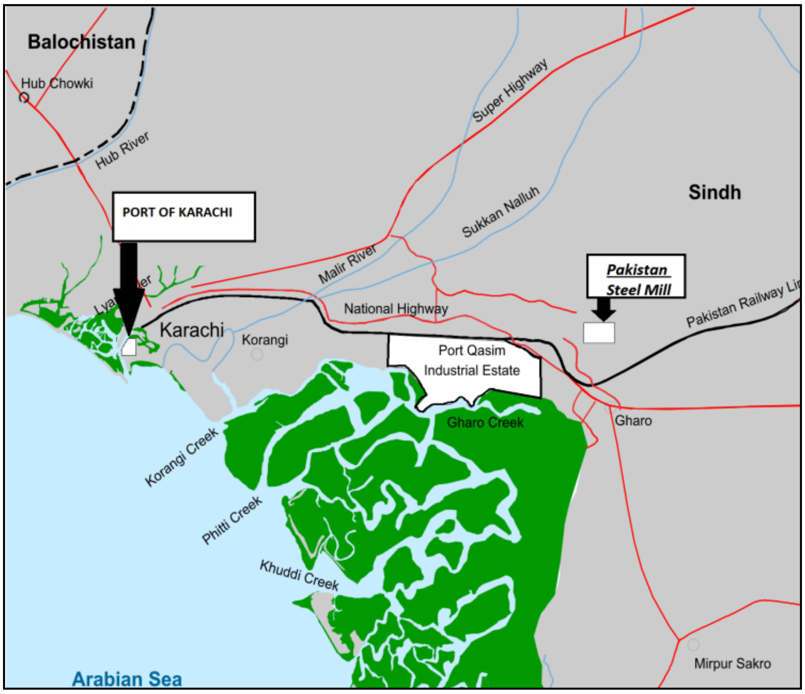


Fig11.1

It is at distance of only 15 km from the national highway, providing direct access to the rest of the country. A further 14km of railway track is present inside the terminal. This is linked to the national railway network through 6 railway tracks. Jinnah International Airport is also very near

In addition to the Pakistan Steel Mills (PSM) and KESC Bin Qasim Power Plant, around 80% of the Pakistan's automotive industry is located at Port Qasim. The port also provides direct waterfront access to two major nearby industrial areas, Export Processing Zone (Landhi) and Korangi Industrial Area. Approximately 60% of country's export and import is originates from these areas.

- **Gwadar Port**

Gwadar is located on the southwestern coast of Pakistan, close to the important Straits of Hormuz, through which more than 13 million barrels of oil passes per day. It is strategically located between three increasingly important regions of the world: the oil-rich Middle East, heavily populated South Asia and the economically emerging and resource-rich Central Asia. It is Pakistan's 3rd busiest seaport

Fig11.2



The construction of the Gwadar deep-sea port is just one component of a larger development plan which includes building a network of roads connecting Gwadar with the rest of Pakistan, such as the 650 km Coastal Highway to Karachi and the Gwadar-Turbat road (188 km). This network of roads connects with China through the Indus Highway. Pakistan, China, Kazakhistan, Kyrgizstan and Uzbekistan are developing extensive road and rail links from Central Asia and the Chinese province of Xinjiang to the Arabian Sea coast.

The Pakistani Government has initiated several projects, with major financial and technical assistance from China, to develop Gwadar's strategic location as a goods transit and trade point. The primary project is the construction of a deep-sea port at Gwadar to enable high-volume cargo movement to and from the landlocked Central Asian states. The new port will also encompass conversion facilities to allow for the movement of natural gas as a part of plans for a termination point for the Turkmenistan-Afghanistan-Pakistan natural gas pipeline. The secondary project is a coastal highway connecting Gwadar to Karachi, whose $200 million cost will be completely financed by the Chinese. Gwadar will serve as a port of entry for oil and gas to be transported by land to the Western regions of China



Other ports of Pakistan (Pasni, Jiwani etc) are less developed because of the lack of government investment to develop them. They are primarily fishing ports which handle very little import/export of cargo. This is because most of Balochistan's interior is thinly populated and less developed. Thus there are less number of people who may want to import say luxury goods. Since there is less industrialisation there. Therefore, fewer surpluses of goods is produced for export (the little surpluses can be easily handled at other major ports). Furthermore, there are few crop areas in Balochistan, so there are less crops for export, neither there is a heavy demand for imported fertilizers. Also, these areas have poor access to the transport network, so even if goods were to be exported/imported from these ports; the transport costs would be too high

SEA PORT FACILITIES

- Fire extinguishers
- Coast Guard
- Docks for maintenance of ships
- Passenger lounges
- Re-fuelling of ships
- Warehouses
- Offices
- Water, Communication and Transport facilities
- Quarantine and Storm-Shelter Area

This cargo shipping terminal has a **single large wharf** (whole paved structure with containers) with **multiple (3 visible) berth**s (places where ships dock for loading and unloading of cargo)

Fig11.3



TRANSPORT IN PAKISTAN



PICTURE BY BILAL MIRZA

*Road Network of Pakistan
Distribution and density
Importance
Limitations
Future Plans

*Air Network of Pakistan
Distribution and density
Importance
Limitations
Future Plans

*Rail Network of Pakistan
Distribution and density
Importance
Limitations
Future Plans

*Dry Ports

ACKNOWLEDGEMENTS

Fig12.1 and Fig 12.3 Nauman Mohammad



Fig12.1

Road Network of Pakistan

Pakistan has a total of 259,000 km of roads out of which around 66% are paved, while the remaining 34% are unpaved

Distribution and Density of Road Network

Sindh

- In Sindh the major highways, N-55 (also known as Indus Highway) and N-5 run along both banks of Indus in the South-North direction.

They connect Karachi, Thatta, Hyderabad and Sukkur etc

- There's a motorway that connects Karachi and Hyderabad. These two cities are two main foci of the road network in Sindh.
- M-10 is found near Karachi

Punjab

- As the highways in Sindh enter Southern Punjab they still follow both banks of Indus and then move away from Indus. As we move North, we see that many cities are interconnected with a web of **dense** road network along banks of rivers and also across the doabs, with main foci being Lahore, Faisalabad and Multan
- Two motorways connect Lahore with Faisalabad and with Islamabad.
- A major road also leads from Lahore to Wagah and eventually into India.
- Furthermore, two roads from Bahawalpur and Multan respectively, merge into one near the border and then lead to India

Balochistan

- In Balochistan, the main focus is the city of Quetta, from which roads lead in all direction. To North we head to Chaman and Afghanistan. Another road leads West to Dalbandin and then to Iran.
- To North-East leads to Western Punjab and to Southern Khyber-Pakhtunkwa through Zhob. One road also leads to Sukkur in Sindh
- N-40 and N-25 form RCD highway connecting Quetta and Karachi with Iran
- Near the coast Makran Coastal highway connects Gwadar and other fishing centres like Pasni with Karachi

Khyber-Pakhtunkhwa

- The Indus Highway connects Dera Ismail Khan with Peshawar. From Peshawar a highway leads into Afghanistan at Torkham through the Khyber pass
- M-1 connects Peshawar with Islamabad, and then other highways connect Peshawar with Northern areas of Kalam and Chitral

Gilgit-Baltistan and Azad Kashmir

- Karakoram Highway connects Hassan Abdal with China via Khunjerab Pass, after passing through Abbottabad and Gilgit
- Murree Express Highway connects Islamabad with Murree and Muzaffarabad

Reasons for Distribution

- The road network of Punjab is the densest followed by Sindh and then of Balochistan. This is because there is a lot of population in Punjab which needs to be connected.

- Balochistan has a rugged terrain along with a low population, which makes road building difficult and uneconomical (as they will be used by very few people)

- In Khyber-Pakhtunkhwa, the road network connects different valleys like of Peshawar with other areas. Like Balochistan, the rough terrain has limited the density of the road network

- There are more foci of road network in Punjab because many major cities are located here due to their economic prosperity

- The main pattern of road network in Sindh is South-North, because roads follow banks of River Indus and that there's only one river in Sindh. Also on East we have more or less an inhospitable area of the Thar desert

Importance of Road network

- It is the most versatile form of network, meaning it can serve a lot of areas which rail and air systems can't serve, because laying out rail and air networks costs a lot of capital
- Provides door to door service
- Most of the goods transported inside Pakistan are on the road network, including commodities like oil from pipelines to city areas and to gas stations
- It can serve areas 24/7, there is no waiting for the rail carriage to arrive etc, goods can be transported any time
- It is cheap over short distances as compared to air or rail network
- It has little documentation involved which can be complex in rail and air transport
- There is little time wasted during uploading and receiving of goods, which is a common hassle in rail and air transport due to innumerable checks like for safety and for weighting the goods etc

Limitations of Road Network

- It is expensive and time consuming over long distances
- It can only carry goods in limited quantity as compared to air and especially rail transport
- It is also affected by traffic jams
- Like rail network it may not be able to serve some areas like the Northern Mountains which air transport can only serve. This is because of the harshness of the terrain, which makes it expensive to construct roads. Landslides are a common problem too.

Recent Developments and plans for future

- M4 is being constructed in Punjab; it will link Southern Punjab with the motorway network, by joining cities of Faisalabad and Multan. It will be completed in 2012, have 4 lanes and also will have the capacity to accommodate two further lanes
- M8 is being developed from Gwadar to Ratodero in Larkana Sindh. It will serve as a gateway to the Makran Coast. It will have 4 lanes
- Islamabad-Murree-Muzaffarabad Expressway is under construction. Only the Murree to Muzaffarabad section is yet to be built while the rest of expressway is done. It has 4 lanes
- Torkham-Peshawar Expressway is also planned. Torkham is the busiest port of entry between Pakistan and Afghanistan, it being a major shipping, transporting and receiving centre
- Sialkot-Lahore Expressway is also under consideration, improving trade between these two very important cities
- M-7 is being planned which will connect Rotadero with Karachi
- M-6 is being also planned. It will connect Dera Ghazi Khan with Rotadero, with Dera Ghazi Khan being an important centre for cotton textile and ghee industry
- M-5 will connect Multan with Dera Ghazi Khan, thus completing access of whole of Southern Punjab with the motorway network

ADVANTANTAGES OF DEVELOPING MOTORWAYS IN PAKISTAN

They help in promoting industrial growth as both products and raw materials can easily be transported between different cities. The operation of dry ports can also be improved because if any problems in the rail network occur; motorways can be used to transport the goods quickly to and fro from the port

Industrial growth is encouraged in the areas which are near to the motorways. These motorways are wide (6 lanes) and have good quality surfaces, for smooth passage of traffic

Congestion from other highway/roads is relieved and motorways might cut through a previous long route, which now becomes shorter. This helps industrialists in meeting orders on time.

Tourists and other professionals (engineers) may find it easier to reach some areas. New tourist may bring in more money and employment for the local people

DISADVANTAGES OF DEVELOPING MOTORWAYS IN PAKISTAN

Motorways are expensive to build and maintenance cost is high (as they are very long). Furthermore, they require a lot of time to build

Industrial growth may be limited as motorways may not be the most suitable to for example a producer, who produces and sells his goods in bulk. He would prefer railways as roads cannot carry goods in bulk economically

Also, these motorways don't always connect all major towns etc; they only connect major cities together. Thus the chronic poverty in rural areas may still not be solved

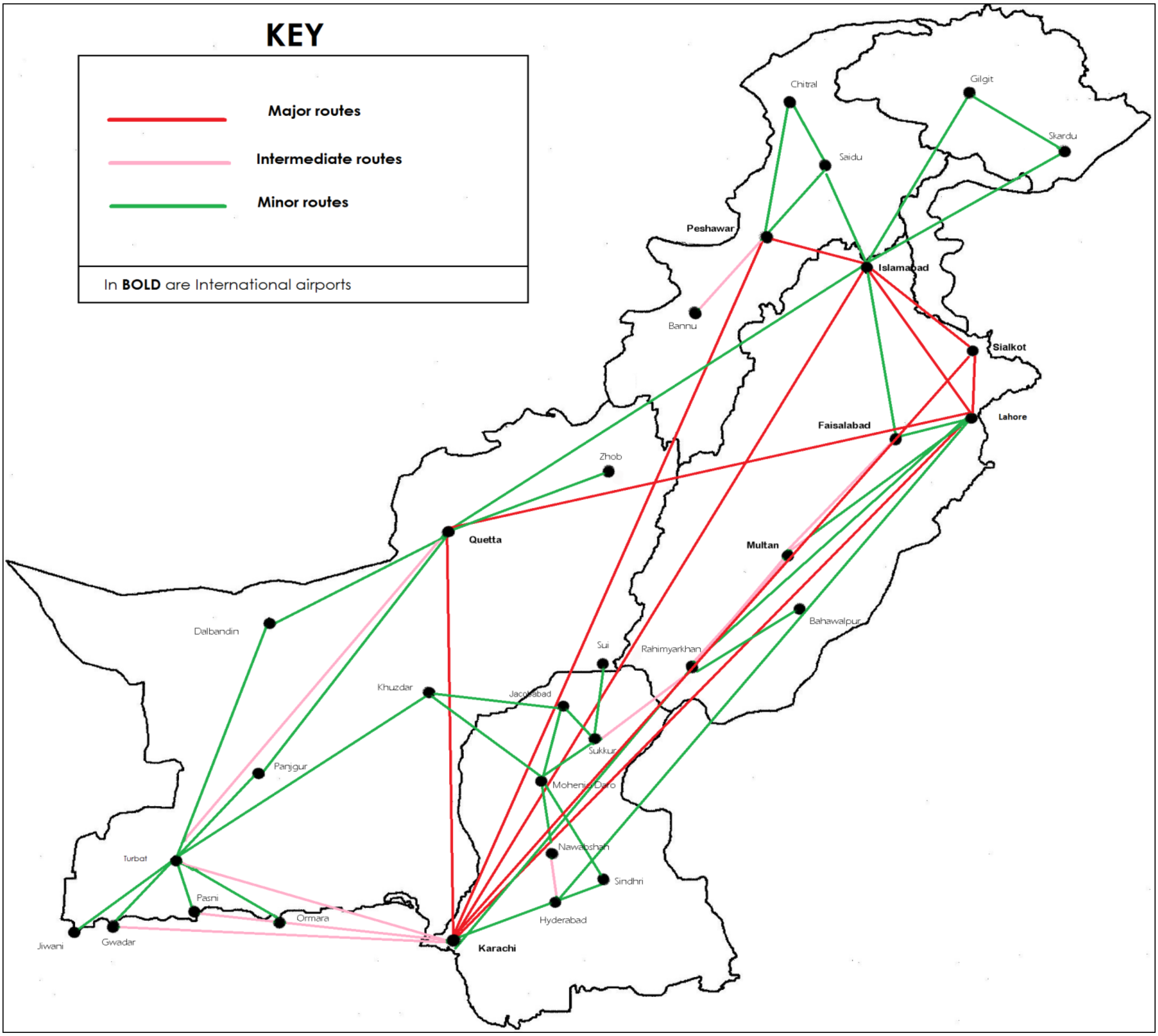


Fig12.2

Distribution of Air Routes

- Most of the air routes follow the South-North direction, with less following East-West direction
- Most of the air routes run across the Indus Plains
- Karachi has the most flights in the country. Lahore, Faisalabad, Multan, Quetta and Peshawar are also major foci. All these are international airports along with the newly built airport at Sialkot
- Some minor routes branch from major airports, like Bannu is only accessible by air from Peshawar
- There are few flights in the North of country and also in West Balochistan, where low population and extremes of climate limit the number of passengers and flights

Reasons for Distribution

- There are many flights from Karachi and other major cities because they have an international airport, not only do they serve

domestic commuters but also international commuters
- The airports in bold are located in heavily populated areas where there is a greater percentage of people who are rich enough to afford air transport
- These cities have good transport infrastructure so they are easy to access and thus are preferred over other distant airports
- Areas like Karachi and Lahore etc are located in plain areas, for an international airport a long runway is necessary. Thus to accommodate large planes runway construction is impossible in steep sided hills of Northern Mountains
- Areas like Quetta, Peshawar, Lahore, Karachi and Islamabad are administrative capitals, where important offices of government are located, which need to connected

Requirements for an Airport

- Cheap, flat and abundant land is required for making the most important part of airport that is the runway
- A lot of capital is required for the construction of lounges, parking facilities, control tower etc
- Facilities like water supply, electricity, sanitation along with security are necessary
- Trained officers of customs and traffic controllers are also required
- Good transport infrastructure like road and rail network is vital for success
- Nearby population which can use the airport is also a pre-requisite. It's no use building an airport far away from population for example in a desert

Importance of Air Transport

- It is **quick and cheap** over **long distances**, it can serve other continents which is impossible by road and rail
- It is suitable for high value and light weight goods like computers both for import and export etc
- It can serve areas which are cut off to rail and road networks like Skardu
- It is mostly used by tourists coming to Pakistan and is also important for dispersing vital food and medical supplies during for example earthquakes etc

Recent Developments and Future Plans

- The Sialkot Chamber of Commerce has completed the construction of Sialkot International Airport, thus making easier the export of high value and low weight goods, which were previously transported to Lahore airport 125km away. So cost of exports from the city has decreased. Also, the apron will be extended to accommodate more aircrafts with addition of construction of a jet bridge
- Multan International Airport will have an extension of runway from 9,000 to 11,000 feet, increasing the width of runway to 150 feet with 25 feet shoulders on each side E (Suitable for Boeing 747 aircraft). Other improvements will include expansion of terminal buildings. This will allow cargo flights to take place and thus suit the need of growing economy of Southern Punjab
- Gandhara Airport is being constructed to serve needs of Islamabad; it will become the biggest and most modern airport in Pakistan when it is completed in 2011

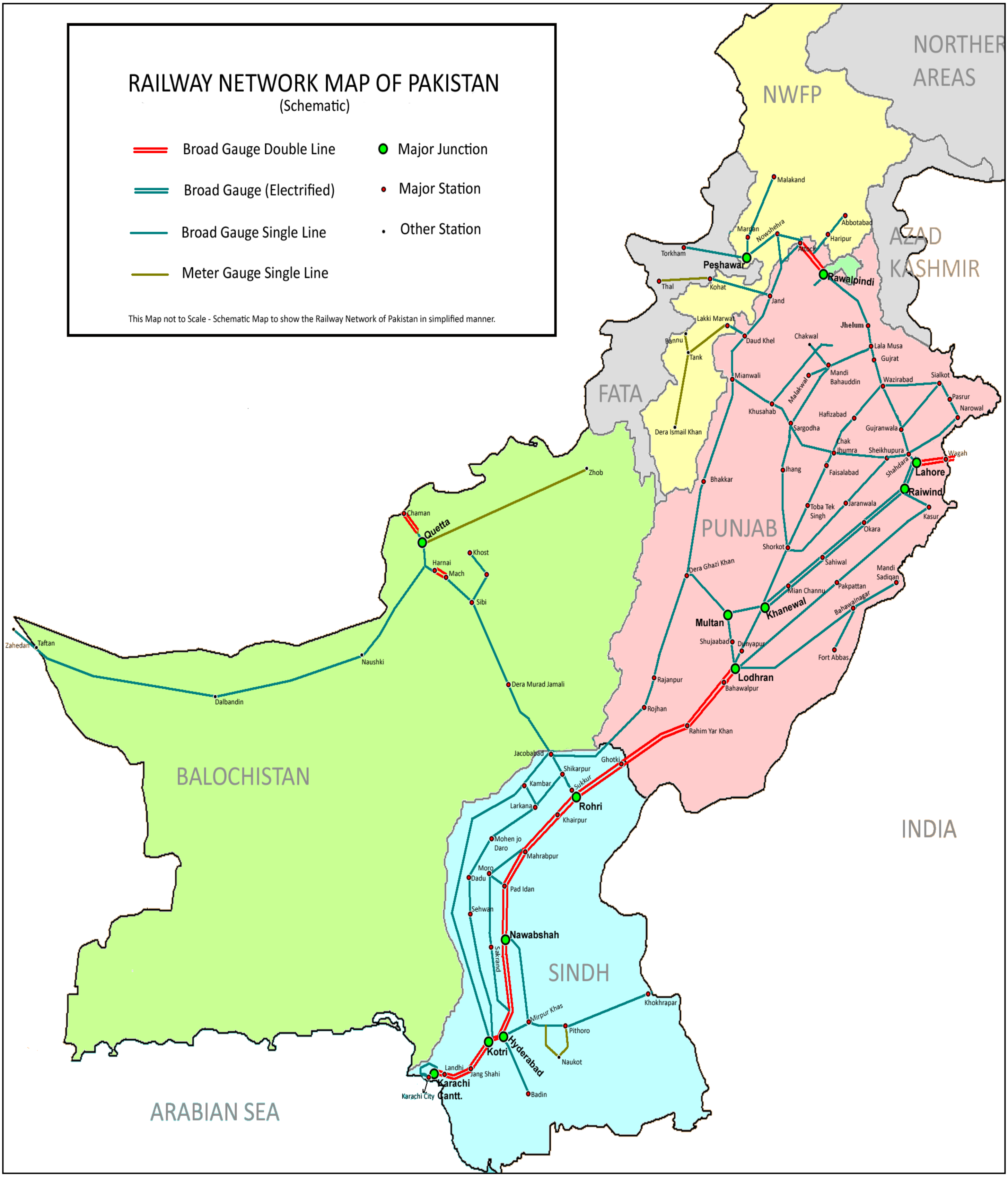

RAILWAY NETWORK MAP OF PAKISTAN
(Schematic)
Broad Gauge Double Line
Broad Gauge (Electrified)
Broad Gauge Single Line
Meter Gauge Single Line
Major Junction
Major Station
Other Station
This Map not to Scale - Schematic Map to show the Railway Network of Pakistan in simplified manner.
NORTHERN AREAS
NWFP
AZAD KASHMIR
FATA
PUNJAB
BALOCHISTAN
SINDH
INDIA
ARABIAN SEA
Malakand
Mardan
Nowshehra
Abbotabad
Haripur
Attock
Torkham
Peshawar
Rawalpindi
Thal
Kohat
Jand
Lakki Marwat
Bannu
Tank
Daud Khel
Chakwal
Jhelum
Lala Musa
Gujrat
Mandi Bahauddin
Mianwali
Malakwal
Wazirabad
Sialkot
Pasrur
Narowal
Khusahab
Hafizabad
Sargodha
Gujranwala
Dera Ismail Khan
Chak Jhumra
Sheikhupura
Shahdara
Wagah
Lahore
Raiwind
Jhang
Faisalabad
Zhob
Bhakkar
Toba Tek Singh
Jaranwala
Kasur
Chaman
Quetta
Okara
Khost
Harnai
Mach
Shorkot
Sahiwal
Dera Ghazi Khan
Mandi Sadiqan
Sibi
Mian Channu
Pakpattan
Multan
Khanewal
Bahawalnagar
Zahedan
Taftan
Naushki
Shujaabad
Dunyapur
Fort Abbas
Dalbandin
Lodhran
Bahawalpur
Dera Murad Jamali
Rajanpur
Rojhan
Rahim Yar Khan
Jacobabad
Ghotki
Shikarpur
Sukkur
Kambar
Rohri
Larkana
Khairpur
Mohen jo Daro
Mahrabpur
Moro
Dadu
Pad Idan
Sehwan
Nawabshah
Sakrand
Khokhrapar
Mirpur Khas
Pithoro
Kotri
Hyderabad
Naukot
Landhi
Jang Shahi
Karachi Cantt.
Karachi City
Badin

Fig12.3

Rail Network of Pakistan

Pakistan has a rail network of around 7,791 km.

Around 7,479km (96%) is broad gauge with 293km (0.04%) of it being electrified. While the remaining 4% is narrow gauge

Distribution of Rail Network

Sindh

- The rail network in Sindh starts from Karachi, where broad gauge double lines lead to Hyderabad, and then follow the bank of Indus into Northern Sindh towards Rohri
- A broad gauge single line branches from Hyderabad and heads onto Khokrapar and then into India. Also many broad gauge single lines connect small cities in Sindh which are west of Indus including Dadu and Larkana etc

Balochistan

- From Rohri in Sindh, a broad gauge single line branches and heads to Quetta in Balochistan. From Quetta a broad gauge double line leads to Afghanistan through Chaman, while another single line leads to Iran via Dalbandin and Taftan. Density of rail network is very low

Punjab

- From Rohri the double broad gauge continues till Lodhran
- From Khanewal to Raiwind and ultimately Lahore a broad gauge double line (electrified) runs
- From Lahore a broad gauge double line then runs through Wagah into India
- The pattern of railways across the most of Punjab is across the doabs and across the banks of Eastern tributaries of River Indus. Broad gauge single line are the most common

Khyber-Pakhtunkhwa

- From Rawalpindi a broad gauge double line operates till Attock, after which all major cities of Khyber-Pakhtunkhwa are served by broad gauge single line or narrow gauge single line. Density of rail network is low

Importance of Rail Transport

- Rail transport is cheap over long distances inside a country
- It is also quick for long distances within a country
- It can carry the goods in bulk, which is impossible with road transport and to a limited extent with air
- It is suitable for low value, high weight cargo
- It is not affected much by traffic
- It is vital for success of dry ports and for deep sea port of Gwadar, unless Makran coast is provided with a modern rail link the prospects of Gwadar developing are bleak

Limitations of Rail Transport

- The maintenance of railway tracks is a very costly process, involving much labour and capital
- It is expensive to send small amounts of goods over a short distance
- Railways operate by a fixed schedule so rail transport isn't flexible nor is it door to door
- A lot of time is wasted during unloading and uploading of cargo, during which it can be either stolen or lost as different trains operate on different gauges
- The rail infrastructure in Pakistan is very old and unreliable prone to accidents which kill many hundreds of people annually

Recent Developments and Future plans

In it was announced in 2007 that a railway line between Gwadar and Quetta will be built and the Bostan-Zhob narrow-gauge railway line will be converted into broad gauge at a cost of US$1.25 billion. Plans to increase train speeds, install more lengths of double track and to convert the country's railways to standard gauge are also currently under work. A feasibility study has been initiated to construct a rail link between Havelian (in Mansehra district Pakistan) and Kashgar (in China) via Khunjerab Pass. Thus giving China access to all year around warm waters of Indian Ocean

- A $2 billion project for whole electrification of railways was launched in 2005 to continue till 2010
- A mass transit system is planned for Lahore to be completed by 2020; it will serve many hundreds and thousands of commuters daily. Also a mass transit system is planned for Karachi

DRY PORTS

They are inland ports, which are basically terminals inland and are directly connected to ports by either rail or road networks. They can be export or import orientated. For example the Sialkot dry port is export orientated meaning that it is organized in such a manner that in which it is much easier to export goods as compared to importing goods.

Features of a dry port are:

- Facilities for storage, preservation and consolidation of goods
- Refrigeration facilities
- Loading area with lifts and cranes etc
- Custom clearance services
- Connection with road and railway infrastructure

Importance of Dry Ports

Dry ports have custom clearance services, which mean that goods are cleared before they reach port, thus saving hassle at port. Time is saved this way and goods can be exported easily and on schedule.

Storage space is saved at the port area as goods are only sent from the dry port only when they are needed by the schedule

Furthermore, containerization means that there is less of a chance to damage to goods or that they may get stolen, as previously goods had to be sent to port where they would be then put in containers

Taxes can be collected at the dry port. Also, less storage space is required at the sea port, thus freeing up land for extension of port

Refrigeration facilities are present so perishable items can be stored and need not to be delivered directly to the port **immediately**.

Transport charges are reduced as now goods are transported in bulk and this lowers the cost to importer/exporter.

Producers inland can easily export their products (at higher price than what they would have sold to domestic consumers), this incentivizes them to produce more and improve the quality of their goods (to attract more foreign customers)

At present, there are six dry ports running under the management of Pakistan Railways:

- Lahore Dry Port Established in 1973
- Karachi Dry Port Established in 1974
- Quetta Dry Port Established in 1984
- Peshawar Dry Port Established in 1986
- Multan Dry Port Established in 1988
- Rawalpindi Dry Port Established in 1990

In addition to the above, there are four Dry Ports established and running under the management of private sector

- Sialkot Dry Port Established in 1986. Busiest dry port in Pakistan. First private dry port in Asia
- Faisalabad Dry Port Established in 1994
- Pak-China Sust Dry Port
- NLC Dry Port at Thokar Niaz Beg Lahore
- NLC Dry Port at Quetta

TRANSPORT INFRASTRUCUTRE OF BALOCHISTAN

The transport infrastructure in Balochistan consists of very few roads, railways and airports.

Reasons

The population in Balochistan is around 8-10 million people (4.6% of Pakistan), which is very thinly spread across the province (mostly in rural areas). Since there is little urban population (involved in commercial activity) the government authorities have felt that there was a lesser need to develop infrastructure there

Also the security situation in Balochistan hinders development as many contractors are afraid of getting kidnapped or killed. Government is also not keen to invest as it thinks that the investment won't pay off during the desired period (little industrialisation will take place as the labour force is not trained etc)

The topography of Balochistan is also very rough. There are deep narrow valleys along with parallel mountain ranges, which are difficult to penetrate. Cost of building is high (as raw materials are located in factories of Punjab and Sindh, they are expensive to transport). Moreover, it is near impossible to use machinery on these dangerous slopes

Furthermore, the working conditions aren't the best. It is difficult to transport food and water from the valleys to far away mountain

ranges especially when little previous road/rail network exists

Importance of Good Transport Infrastructure to Balochistan

It will lead to rise in urbanization and commercial activity. Rural-Urban migration will increase; more people would now be available for working in factories/industries

Raw materials, products and employees can easily be transported. All of these are required for the proper functioning of a factory

It may lead to building of Export Processing Zones and Industrial Estates, which will attract foreign as well as local investment into the industrial sector.

It will be easier to move things like cement and steel from factories in other areas to places like Dasht River etc (which could be dammed to store water for irrigational use). Thus the total farmed area can be increased leading to lesser food prices in the local markets. Also, cheaper raw materials will be available for agro-based industries

Better utilization of local resources such as fisheries (better access to markets) and minerals (machines have access to mines) could take place, which will help increase the provincial budget and increase employment. Tourist industry may also flourish (as tourist can access more historical/ cultural sites etc). Thus people would be able to earn more in these sectors as compared to agriculture (their living standard will rise)

Education, health and other services can be improved as more people would now be able to reach schools and hospitals

Development and growth of Gwadar Port may take place as it will be easier to send and receive goods from the port on time, which is necessary for fulfilling foreign orders etc. Trade via Gwadar port by the Central Asia States and China may dramatically increase thus increasing tax revenues of Pakistan

Emergency services in aftermath of floods/ drought and earthquake may be improved, so rescue crews have access to more people in a short period of time, thus helping to save more lives

NOTE

IN PUNJAB, THERE ARE **MULTIPLE** RIVERS ALL OF WHICH ARE **WIDE** AND **CAN FLOOD**. THUS THE **COST OF BUILDING AND MAINTAINING BRIDGES** IS HIGH

TELECOMMUNICATIONS IN PAKISTAN



*Means of Communication

*Importance of Communication for Industry and Business

*Importance of Communication in Education and Alleviating Poverty

PICTURE BY FAISAL SAEED

COMMUNICATION

Successful communication occurs when the sender sends the **correct message** to the receiver, who understands the message and if necessary gives a reply acknowledging that he has **understood** the message and if necessary acted upon it

Pakistan has around a million broadband users and around 100 million mobile subscribers. The growth rate of telecom industry is one of the highest in the world

MEANS OF COMMUNICATION

- Internet/Email
- Telephone
- Mobile
- Fax
- Radio
- Video Conferencing

IMPORTANCE OF COMMUNICATION FOR INDUSTRY AND BUSINESSES

- **BUYING AND SELLING**

Communication helps in locating the supplier, as the customer can search and then order the goods online etc or on the phone. This is done within a country and also internationally. This is much quicker and cheaper than going to the offices of the producer etc

The producer can advertise his goods online etc. He can also show his customers the progress of their orders. Furthermore, the mode of transport and the means of payment can both be decided

- **DEVELOPING INDUSTRY**

Machinery can be searched over the internet, prices and specifications of different models can be compared. Pictures and videos of demonstration models can also be seen. Reviews can also be read, therefore, the best choice can be made

Advertising can increase sales and market share, thus increasing a company's profit and eventually freeing up capital for investment in the business

People for important posts can be hired through online advertisements; this means that the best people from a wide pool are selected for the job

Foreign investors can read news of promising new developments in other countries. For example news of Thar Coal deposits have generated excitement in mining circles. This interest can fuel the proceeding contract bidding process and help make sure that the best bid is selected

Bank policies and interest rates can be determined online or on the phone. Online payments can also be made quickly, so there is no need to go to banks (saves time)

Furthermore, training of employees can be done by showing them video clips etc. Research papers into new techniques can be

read and the techniques then implemented in the workplace

Video conferencing can be done between managers in different cities and countries, thus a decision which is beneficial to all of the branches of a company can be implemented

IMPORTANCE OF COMMUNICATION IN EDUCATION AND ALLEVIATING RURAL POVERTY

- **EDUCATION**

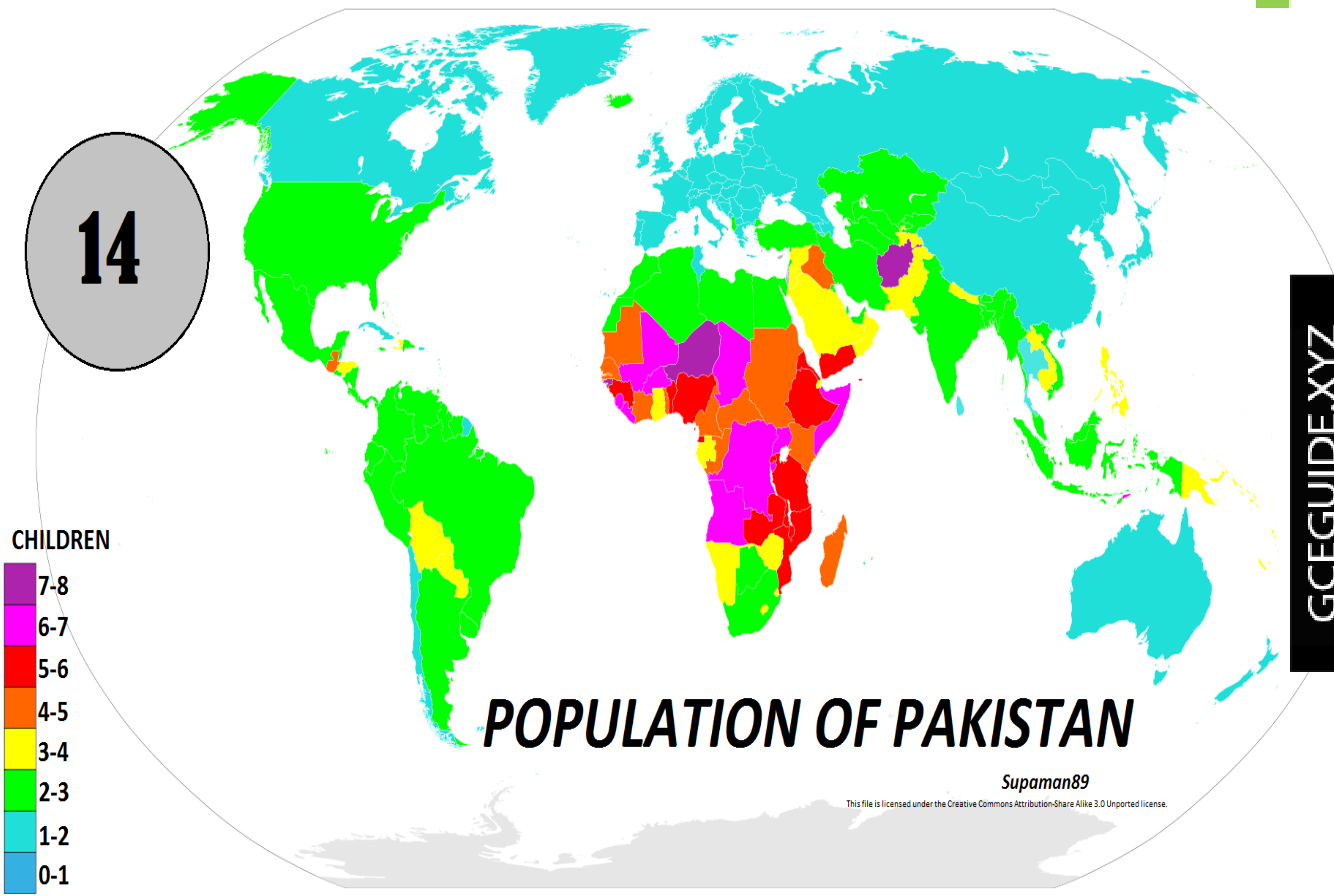
Communication can play a vital role in the very important sector of education. Pakistan has the largest Wimax network in the world today

This can be used to broadcast television lectures to children in schools etc. Lectures can be recorded and put online. They can be listened to again and again, rewinded and moved forward. People can now learn at their own will. Videos can be made of complex models and also put online. All of this means that one teacher can do the work of a million teachers to a certain extent

- **ALLEVIATING RURAL ROVERTY**

Use of telecommunication is probably the most under estimated way of alleviating rural poverty in Pakistan. As demonstrated above if the field of education can be handled via telecommunications then this can help in controlling population growth. This is so because rural communities will be able to realize the benefits of smaller families

Also telecommunications help in increasing agricultural productivity; farmers can be demonstrated new methods of planting, growing and harvesting crops. Also, weather patterns can be shown to farmers (rain forecast, chance of pest attack etc) so they can plan their processes. This will result in increasing yields and will lead to increased profits, so more money will be available for investment in fertilizers, insecticides etc


14
CHILDREN
7-8
6-7
5-6
4-5
3-4
2-3
1-2
0-1
POPULATION OF PAKISTAN
Supaman89
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ACKNOWLEDGEMENTS

Fig14.5	**Nauman Muhammad**
Fig14.7	**Sarfraz Hayat**
Fig14.8	**Daniyal Gilani**
Fig14.9	**Sarfraz Hayat**
Fig14.10	**Ahsaan Ali**

Population

Population is the number of people living in a specified area

Terms:

- **Birth rate** : The average number of births per thousand people
- **Death rate** : The average number of deaths per thousand people
- **Rate of natural increase** = Birth rate (minus) Death rate
- **Overpopulation** : When an area's population is too large to be supported by its available resources like wealth, food, fresh water and land
- **Demographic transitional model** : Graphs suggesting sequence of change in relationships between birth and death rates over a period of time
- **Population structures**: It is the percentage of males and females in different age groups. Depends on the population's birth and death rates and life expectancy of a particular area. It is divided into age groups for both males and females
- **Population pyramids**: It is the graphical representation of population structures

Population Growth of Pakistan and its reasons

Economical

- Pakistan has a high rate of population growth because most families in Pakistan are poor and thus need a source of income. Hence, the children serve as labour (child labour), so large families are preferred.
- Pakistan has a high birth rate because rural areas have a high infant mortality rate (number of deaths of infant under 2 per 1000 infants). So people have more children in hope that some of them will eventually survive and will be able to earn for them eventually

Social

- There's a high illiteracy rate for women in rural areas, thus they are not aware of the problems caused by high birth rates. Education is key to birth control and social awareness
- There is a strong desire for sons in the country's social setup as most of the population lives in villages where the prime source of income is from agriculture and sons are required to carry out farming activities.
- Children are desired as they are expected to take care of their parents when they are old.
- The deadly affects of climatic hazards such as floods, droughts and diseases etc, have been reduced tremendously due to scientific advancements and development in country's infrastructure (therefore the infant mortality rate has dramatically been reduced)

Religious

- Some people believe that God gives 'rizq' to everyone so there is no need to control population as God accounts for all their needs. No matter how many children they will have they would be able to feed them
- Disapproval of birth control measures and family control projects on religious grounds

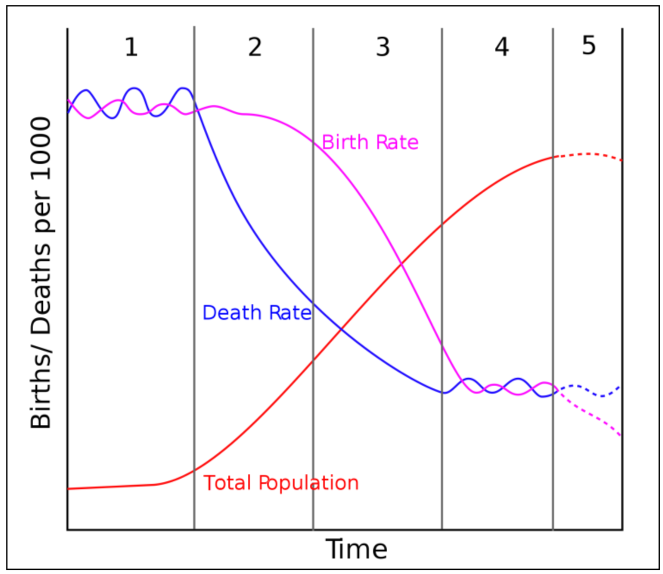
Political

- Frequent change in government leads to change in population control projects, thus diverting resources and attention from this important issue
- The entry of large number of refugees from Afghanistan after 1979 due to war, political instability and drought into Pakistan has given rise to a huge increase in population. Refugees were considered brothers and welcomed here by other tribesmen along a porous border

Demographic transitional Model

The graph suggests there is a sequence to the change of relationship between birth and death rates over a period of time

Fig14.1



Stage 1

This indicates high birth rate (moderately stable) while the death rate is also high but with many fluctuations due to sporadic outbreak of diseases, famine etc. There is little natural increase in the population of Pakistan. The society of this country is pre-industrial with population mainly dependant on subsistence methods of food production.

Reasons for high birth rates have been explained above, and reasons for high death rates include:

- High infant mortality rates due to spread of diseases like malaria, cholera and inappropriate medical facilities
- Area are isolated and cut off from each other with little communication and transport

facilities. Hence the people have less access to medication and doctors

Stage 2

This indicates the fall of the death rate but the birth rate remains more or less at previous levels. The gap between the two rates widens so as a result the rate of natural increase of population peaks to its maximum. The percentage of the population under 15 increases.

Reason for high birth rates have been explained above, and reasons for stage 2's death rates include

- Better nutrition due to foreign aid and better food growing techniques which increase the yields due to HYV seeds, irrigation, insecticides etc
- Improved public health systems so more infants recover from diseases. This is due to better access to hospitals (improved transport network), availability of doctors and medicines (whose number has significantly increased)
- Provision of clean water and improved sewerage systems, which prevent the spread of diseases

Stage 3

This indicates a fall in the birth rate and the stabilization of the death rate. The growth of a city's population slows down and the life expectancy also increases.

Reason for fall in birth rate in stage 3 includes:

- A campaign of government and NGO's to curb population growth through schemes like **Sabz Sittara** etc
- Increase in literacy rate so more people are aware of the benefits of small families
- Due to increasing urbanization and subsequent ban on child labour etc, parents realize that they must educate their children. This requires money and thus they realize that if their child has to get a respectable job then they must invest in his studies. Eventually parents don't want to have more children because they know they cannot afford to educate all of them
- Due to better medical techniques (and subsequent fall in infant mortality rate), parents realize that they don't require so many children in the hope that some of them will survive till adulthood and then ensure a comfortable old age

Stage 4

Both birth rates and death rates are low with the birth rate fluctuating somewhat due to changes in the economy yet the death rates remains stable. Population growth is slow and at the end of the stage four, the death rates rise slightly as more people become old and are more prone to die

Reasons for low birth rate and low death rate have been explained above

Stage 5

The birth rate falls below the death rate resulting in a natural decrease in population. Reasons for low birth rate and low death rate have been explained above

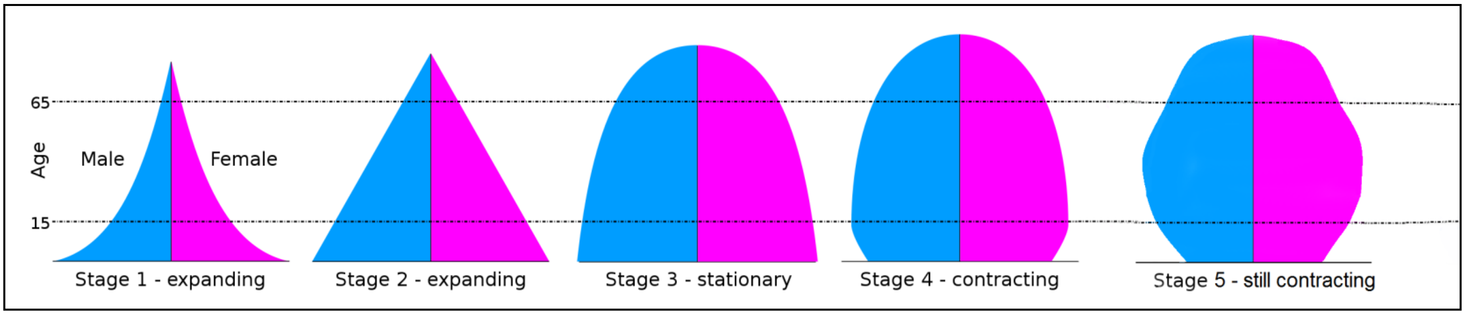
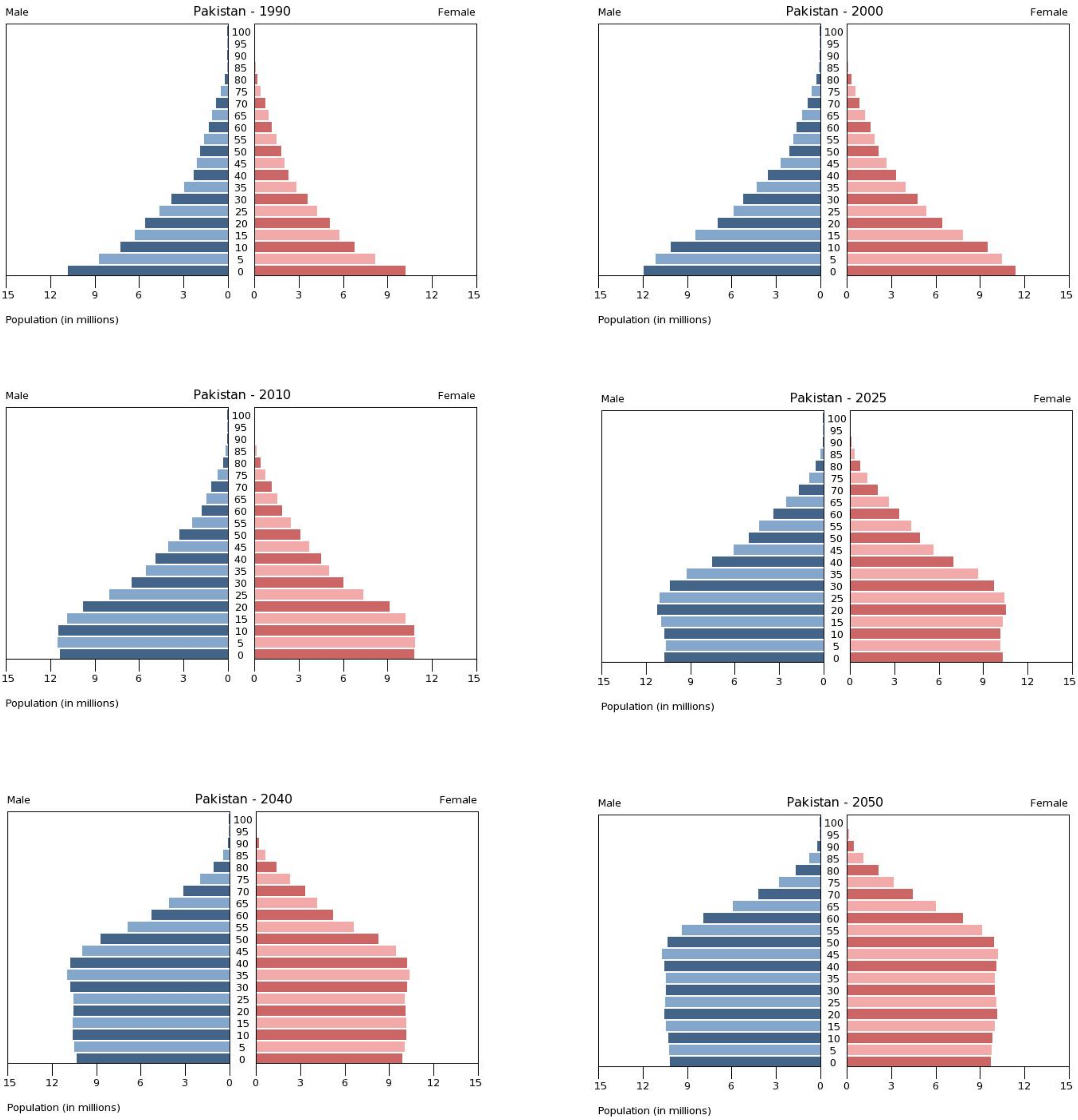

65
15
Age
Male
Female
Stage 1 - expanding
Stage 2 - expanding
Stage 3 - stationary
Stage 4 - contracting
Stage 5 - still contracting

Fig14.2



POPULATION PYRAMIDS OF PAKISTAN

SOURCE US CENSUS BUREAU

Fig14.3

Trends of change in Population Pyramids

In the 1990's there existed a very high birth rate, which accounts for the wide base of the pyramid. The following trend shows that the birth rate will continue to decrease

The number of people who are in the independent group (14-65) will continue to increase throughout the 50 year period

Furthermore there will be a rise too in the dependant group (65 and above), because most middle aged people at present would then become old aged and would require attention from the independent group

Overall the shape of the chart will become less and less pyramidical, with the pinnacle still at the top but the wide base now moving up into the centre positions

Year	Population
1990	118,816,188
2000	152,429,036
2010	184,404,791
2025	228,385,138
2040	269,151,265
2050	290,847,790

Problems due to Over-population

- Natural habitats are lost as people find alternative means of earning (due to shortage of job opportunities) such as cutting wood and selling it, which destroys ecosystems of many animals. This may cause a decline in tourist industry
- With increasing population, the country's expenditure on agriculture increases (to grow more food) leaving fewer finances to account for Pakistan's industrial and tertiary sector development
- Illiteracy rises because education spending decreases thus resulting in a shortage of schools as funds are deviated towards basic necessities
- Living standard of the old population falls as pensions and welfare benefits decrease and other facilities such as hospitals, old homes (to take care of elderly) become scarcer
- Also, life expectancy falls as people are more vulnerable to diseases due to degrading health services
- Unemployment rises and some children are forced to take up low value jobs by giving up their education to support their families (child labour)
- Pollution may also increase as increased human, industrial waste etc is produced, which exceeds the capacity of waste treatment plants
- The country begins to import goods when the demand is not met locally, hence foreign exchange decreases
- Poverty among people increases as government cuts back on job creation etc to pay for external debts. These debts are taken to pay for foreign goods
- Crime rate rises as unemployed look to make ends meet

- Inflation rises because of the high difference between high demand and low production. So the goods becomes more expensive
- The working population has to carry more burden of the dependant population in various forms such as taxes etc
- Poverty forces people to live In temporary houses and this leads to formation of slums
- Uneven distribution of wealth occurs as the rich and wealthy can adapt to conditions while the poor cannot (like generators to deal with loadshedding, so businesses owned by the rich can still function)
- Government may have to employ more people than required (overstaffing) to reduce unemployment. These extra people are paid from an institution's annual income (thus inefficiency increases)
- Traffic increases which leads to other issues such as people more roadside accidents (and deaths) and road jams

Reducing Population Growth and Associated Problems

- Educating people about the problems of a large population and pointing out the benefits of having a smaller family through schemes like **Sabz Sittara**
- Increased government expenditure in education and hence building more schools to increase literacy among people
- Promoting new businesses to set up so that the rate of job creation surpasses the population growth rate. Meaning if a million people enter the independent age group (they have to earn money now) annually, then 2 million new jobs are created annually
- Setting up family planning institutions and leading in them in a way that its aim doesn't come in contrary to the religious beliefs of the people
- Advertising the burden upon the economy due to the high rate of population
- Providing benefits to smaller families like tax reliefs etc. This encourages people to have more children

Consequences of an increase in dependant age group (0-14 & 65 above):-

- The working population has to carry more burden of the dependant population in various forms such as taxes. These taxes are spent on healthcare for the elderly etc
- The government is forced to spend more towards old age benefits and facilities hence funds are deviated from other sectors of economic importance
- Living standards fall as expenses incurred increase, such as that to buy food/clothes for young children. People have less money to buy a new home/car etc
- People and industries may struggle paying high amounts of taxes
- The dependency ration also increases
- There is a shortage of schools, educational opportunities and teachers, which results in a higher rate of illiteracy
- Children may be forced to take up jobs in order to supplement family earnings
- An increased demand for jobs as the dependant ratio 0-14 will eventually move up the age scale and enter the independent age group
- There will be more competition for jobs and the unemployed may indulge in crime to attain survival
- The old may provide advice to their children and grand children (childcare, social and religious)

MIGRATION

Rural-Urban

It is the migration of mostly young and middle aged people (16-40) from rural areas to urban areas. These people are mostly males and thus alter the population pyramids of cities and rural areas. They do send some of their money back to their rural homes or their families also move with them into the cities (but it is rare, as whole family may not find enough jobs to sustain the whole of the family)

Factors resulting in rural to urban migration

Rural Push factors

- Lack of employment opportunities in rural areas and hope of better employment in cities
- Limited educational facilities motivates people to move as better institutions are more likely to be in the urban areas
- Droughts may damage the farmlands leaving it unsuitable for farming purposes
- Water logging and salinity also damages the farmland
- No law and order may result in improper carriage of justice
- Standard of living maybe poor and better standard of living maybe expected in the urban areas
- Less access to highly qualified doctors and hospitals
- Shortage of clean water for sanitation and drinking
- Traditional lifestyle maybe unacceptable to the new generations
- Lack of shopping opportunities
- Limited access to electricity and gas supplies

Urban pull factors

- Better chances of getting employed
- Chances for getting more highly paid jobs as compared to the rural areas
- Better educational institutions
- Bright lights are a source of attraction for people in rural areas
- More culturally free
- Better law and order
- People in urban areas are usually assured of supplies of food and hence are more reliable
- Recreational and entertainment facilities such as parks, malls etc
- Better infrastructure and easy access to different locations
- Easy availability of hospitals and qualified doctors
- Easy access to gas, electricity, telephones and other means of communication

Consequences of rural to urban migration upon Urban areas:-

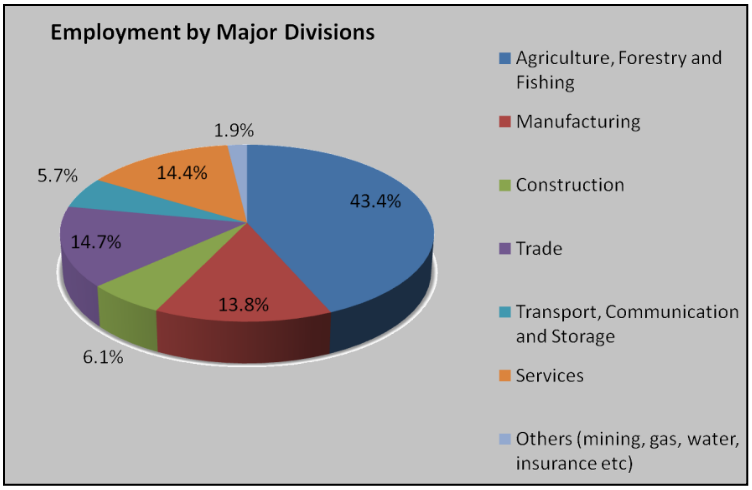
- Burden upon economy in terms of increased demand for electricity, water, gas, communication etc as the urban population increases
- Increased pollution (air, water and noise)
- Traffic issues such as jams and accidents etc

- Increase in the crime rate and violence as the people emigrating maybe illiterate (so face difficulty to find jobs) and unemployment may force them to indulge in such activities
- Poverty of immigrants may result in formation of temporary locations or slums
- Distribution and composition of people changes as more males may come (from rural areas) and increase the percentage of male members in urban areas
- This results in lower agricultural production in rural areas as men are required for planting, growing and harvesting the crop
- As rural areas depopulate the government authorities might shift their attention away from rural areas towards urban areas. This may mean less developmental funds for rural areas to be spent on education/ health etc

Reasons for emigration from Pakistan:-

- Better education opportunities abroad
- Expectations of getting a job
- Chances for higher wages
- Political stability and insecure environment of Pakistan may motivate people to shift
- Terrorism activities in Pakistan develops insecurities among people about fate of their children
- To indulge in a less culturally bound manner of life
- Medical reasons as some diseases are likely to be better treated abroad
- Also some people may wish to support families in Pakistan by earning better abroad

LABOR FORCE OF PAKISTAN



Pakistan has a labour size of over 53.8 million. Most of this labour is involved in agriculture (43%), industry (20.3%) and services (36.6%); with some data incomplete (CIA World Factbook)

Reason for people working in primary sector based occupations

- Working in Primary sector usually simpler skills in comparison to other sectors such as manufacturing and tertiary
- Some people may inherit land and hence become a part of agricultural activities
- Tertiary occupations usually demand a higher level of education and because the illiteracy rate is high in Pakistan people are forced to become a part of the primary sector
- A very large percentage of people live in the rural areas. Here the main occupation is in the primary sector
- Also many people in rural areas are illiterate, thus they can't enter into jobs in the secondary and tertiary sector. Secondary

sector requires education of a certain minimum set standard etc

- Pakistan benefits two cropping season ensuring crop growth throughout the year (permanent employment). Also the growing areas are suitable for farming activities
- Pakistan has an estimated population growth rate of 1.6 percent and so it becomes vital to feed the ever growing population by growing more crops
- Pakistan has reserves of natural gas, petroleum and other minerals such as limestone and gypsum which need to be extracted (mining, fishing, livestock, agriculture and forestry are all primary sector jobs)
- Woodcutting is common in many areas of Pakistan as the demand for fuel wood has increased. This is because many areas of Pakistan are not supplied by gas
- Pakistan has a large amount of fish catch on the coasts of Karachi. The people involved in inland and costal fishing increase the number of people working in primary sector occupation
- Most of industries are agro-based, thus when the profits trickle down to the farmer he has more incentive to cultivate new land. This requires increased amount of labour thus increasing the number of people working in this sector

Reason for decrease in percentage of people working in the primary sector

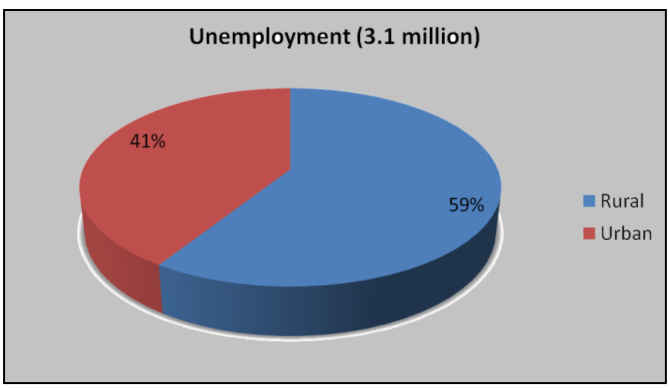
- The repeated division of land in the families after death of father means that the next generation has farms which are very small in size and thus can't provide a permanent or reliable source of income as income is too small
- Waterlogging and salinity has meant that much of the fertile land has been lost and is uncultivatable, thus people have been forced to move into the cities in hope of better employment
- Also with rise in rural education many people want a better paying job (which utilizes their skills) and thus move to the cities in search of it
- Increased mechanization has meant that now less hands are required on the field as a machine can do the work of several persons in less amount of time, with less effort
- Consolidation of holdings has occurred to increase efficiency so some people have sold their lands and now need an alternative source of income
- Some tenants face problems with the landlords, thus they are forced to leave rural areas and move towards the cities
- Industries have also started developing outside of cities (to reduce congestion), thus these industries are now located near the rural areas, thus more rural folks can work in them

Reason for an increase in people working in tertiary sector based occupations

- People who work in the service sector of an economy usually earn higher and so priority is given to jobs in this sector
- With an increase in literacy rate people manage to attain the level of education required to take up jobs in this sector.
- Working conditions in this sector are often better than in primary and secondary sectors
- When the country experiences an overall rise in the standard of living, there is an increase in greater demand for services. To fulfil these demands, there are greater work opportunities in this sector (banking, telecommunications etc)

- Growth of tourism has meant that more people are required to in hotels etc
- Higher investments by government in the education sector have increased the standard of education and so more and more teaching staff is required to run an increased number of schools
- Similarly investments in medicinal facilities requires more doctors and nurses
- Only a limited number of people make things for their own use by themselves and hence the need for retail outlets has expanded
- Increase in population and rise of standard of living has meant more car drivers are required
- Increased industrialization has facilitated growth of banking, insurance etc which has led to increased number of jobs
- Growth of telecommunications (internet and cellular companies) also has led to more people seeking employment in this sector

UNEMPLOYMENT



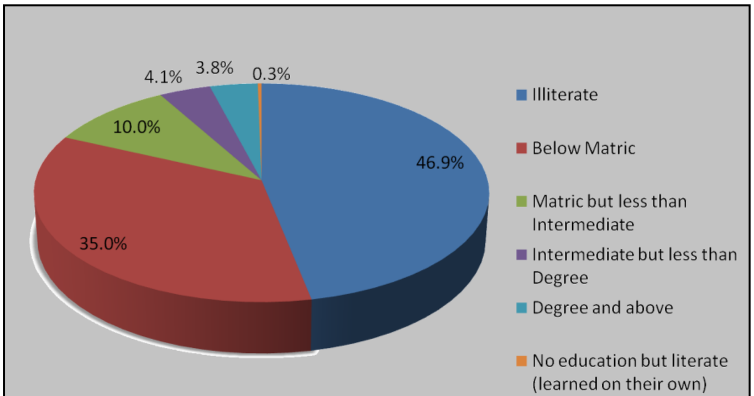
Unemployment occurs when people who have the ability and the will to earn, can't find a job

Causes of Unemployment

- Lack of investments in Pakistan due to political instability hence, foreign businesses don't exist and no extra jobs are created
- High rate of population growth is another important factor as there are limited jobs available
- There is a mismatch in the demand and supply of labour in form of skills, gender, age etc required by the employer. The employer may not candidates for the post
- Some of the people migrating from rural to urban areas in hope of employment may remain unemployed due to illiteracy etc
- With improvements in technology and capital intensive (machinery based) means of production fewer labour is needed and workers are laid off to reduce costs
- With mechanized farming becoming popular such as tractors etc few people are required on the farm

LITERACY

Reasons for High Illiteracy in Pakistan:-



Level of Education (10+years age)

- Lack of investment on the government's part in educational projects
- Child labour results in children leaving education for work
- Lack of priority given to education in rural areas
- There is also a lack of schools and colleges in rural areas
- Poverty results in deprivation of children of education as parents fail to pay for the fee
- Private schools are very expensive
- Lack of teaching staff and lecturers in Pakistan
- Large section of the population are located in the rural areas
- Education is not provided in remote areas
- Large number of remote areas exist

IMPORTANCE OF EDUCATION IN THE DEVELOPMENT OF PAKISTAN

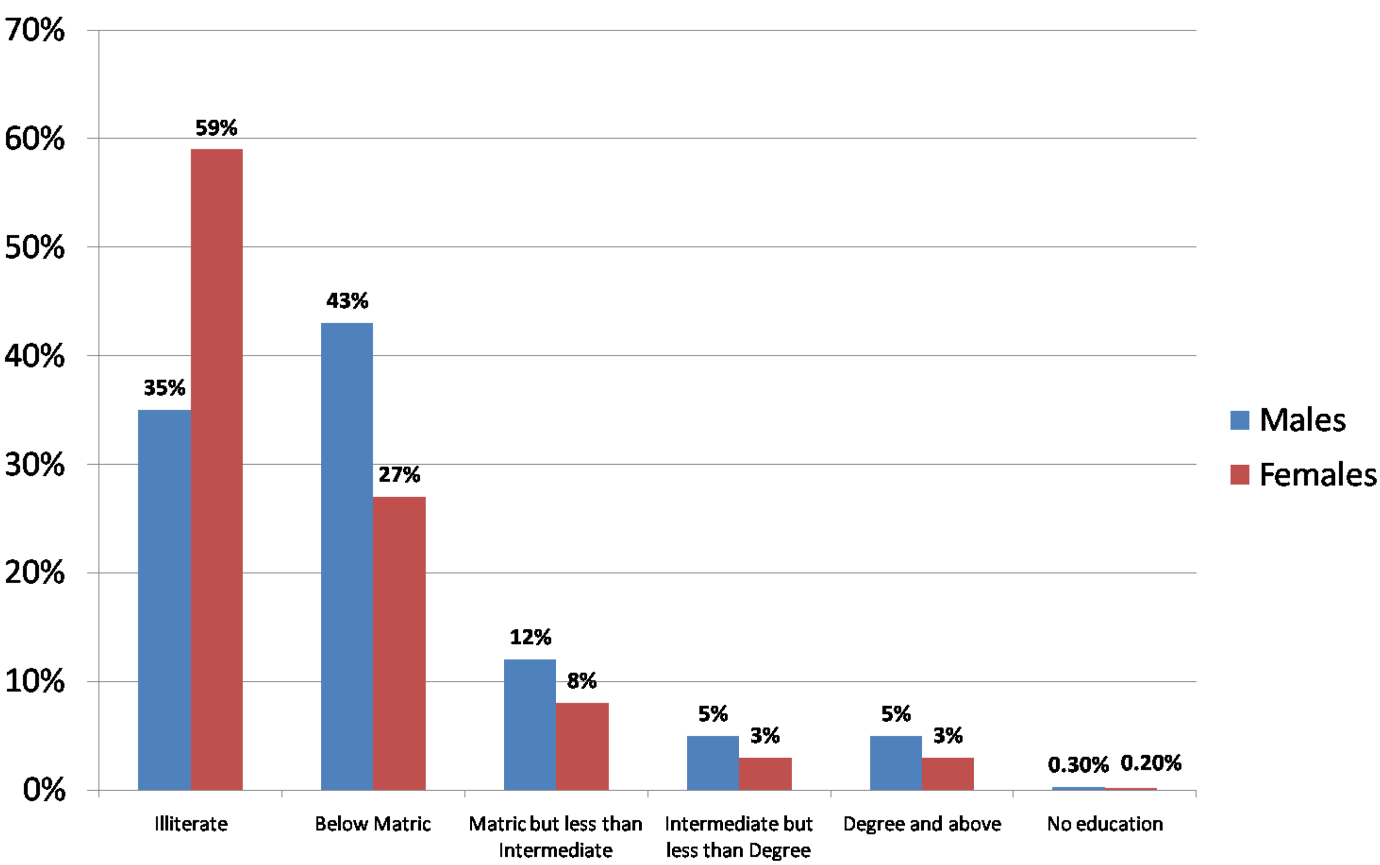
- Education is required to read instructions (on back of a fertilizer bag etc). This gives a farmer the ability to apply the right amount of pesticides/fertilizers and at the right time leading to better yields
- The farmer could read and write (signing bank loans etc)
- Education is necessary for operating big and complex machines like harvesters etc
- Education is also important in fields of extraction of minerals. This is a major hurdle in achieving self-sufficiency in these minerals. Skilled workers are needed to make operate computers and machines etc
- Leadership qualities and organizational skills are required to run large companies successfully in increasingly competitive local as well as foreign markets
- Increased literacy will result in more doctors; thus helping improve health conditions in Pakistan along with nutritional requirements. This will help increase the span of time during which people will be able to serve the state and contribute to its development
- Family planning services will be improved thus providing a better future for rural Pakistanis who would now have more resources per person. This will reduce rural-urban migration
- With the increase in use of telecommunications (internet) to research and learn techniques, make deals etc, the value of education cannot be ignored
- Education also plays a vital role in controlling population growth because:

- It means that people will be much more aware of benefits of small families
- Educated people tend to have good jobs in secondary or tertiary sectors, thus they don't need many children to work on farms etc

Reasons for Higher Female Illiteracy

- Lack of public institutions for girls
- Parents maybe not be in favour of a co-educational school and may not send their girls to get educated
- Poverty results in people choosing to educate boys in preference over girls
- Traditional attitudes influence people in rural areas such as the role of a women is to stay home and that it results in a male dominated society so fewer girls are given schooling

Fig14.4



POPULATION DENSITY IN PAKISTAN

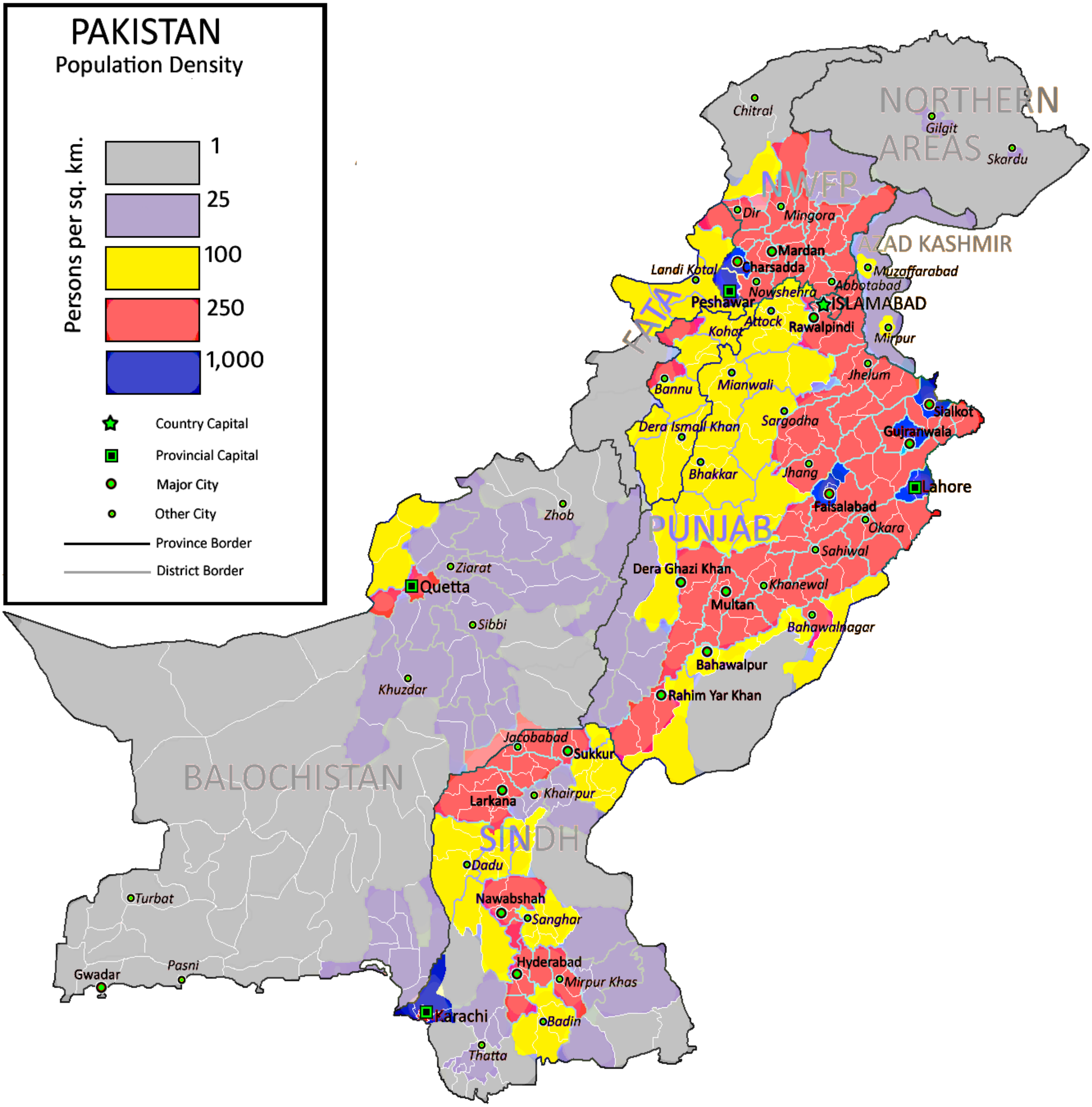


Fig14.5

Description

1000 people per sq km

The densest districts are Karachi, Lahore, Faisalabad, Gujranwala, Sialkot, Peshawar and Charsadda. In Punjab there are 4 densest districts, then Khyber-Pakhtunkhwa with two and one in Sindh. No region in Balochistan has a density of 1000 people per square kilometre

250 people per sq km

The districts are found mainly in Punjab in between the doabs which are east of Sindh Sagar doab. Some districts in northern and central Sindh also have this density. Capital territory and most parts of eastern Khyber Pakhtunkhwa also have many districts with same population density

100 people per sq km

The regions with 100 people per sq km are found mainly in western Punjab, central Sindh, western parts of both Khyber Pakhtunkhwa and Balochistan

25 people per sq km

The districts are mainly found in Balochistan either along the eastern Makran coast or near Quetta district. Other districts are in south-eastern Sindh and parts of Kashmir

1 person per sq km

The districts are found mainly in Balochistan (south west, centre and northwest). Other regions include parts of Gilgit-Baltistan and parts of the Tharparkar desert

Factors Affecting Population Density

- ### Topography

Flat plains with **well drained**, **soft, deep and alluvium rich** soils are perfect for human settlements.

It is easy to build houses on flat plains and operate machines to harvest crops. It is easy to irrigate crops. Furthermore, the cost of laying down railways, roads and runways are low as compared to hilly areas. All of these factors are attractive for investment

Well drained, soft and deep and alluvium rich soil are perfect for crop growth. Well drained soil can retain pockets of air as well as water and nutrients in a balanced amount, which is favourable for plant growth. Soft soil can easily be ploughed and shoots and roots can easily grow. Deep soils mean that the soil will not lose its store of nutrients quickly, thus the amount of fertilizer which has to be applied will be low (thus saving costs to a farmer)

- ### Climate

Areas which have no extremes of climate (temperature, rain, storm etc) are usually heavily populated. This is because suitable temperatures and rainfall are necessary for crop growth, which is necessary for human sustenance. High temperatures cause high rates of evapo-transpiration, which makes growing crops very difficult as plants wilt and then die.

Less people live in the deserts, where they constantly have to move to find food and water.

- ### Infrastructure

People prefer living in those areas where facilities like gas, electricity and water supply

are available. They add to the standard of living

Also industries can be set up easily with little capital costs (as infrastructure is already present), which employ many thousands of people and provide a permanent source of income

Road and rails make the transport of raw materials, products and people (including labour force), quicker and cheaper. This is extremely important for the development of a region as a commercial and industrial hub, which can attract local as well as foreign investment

Furthermore, many business people prefer cities where an airport (international preferably) is found. It helps them to keep up with foreign appointments so they could secure valuable deals for their businesses etc

- **Resources**

Regions where natural resources are available and are being utilized are also thickly populated like the example of deserts of Chile and Saudi Arabia.

The presence of mineral resources means that the excess production can be exported to earn foreign exchange. A share of the profits is given in form of high salaries, which acts as an incentive for people to stay in these areas and populate them

- **Political**

International and local investors are always worried about the safety of their investments. An unstable political situation may lead to fears of social unrest (looting, disruption of supplies and failure to meet deadlines for orders). In this case the investor fears that he may not be able to get his returns and thus abandons further investments and withdraws what he already has invested.

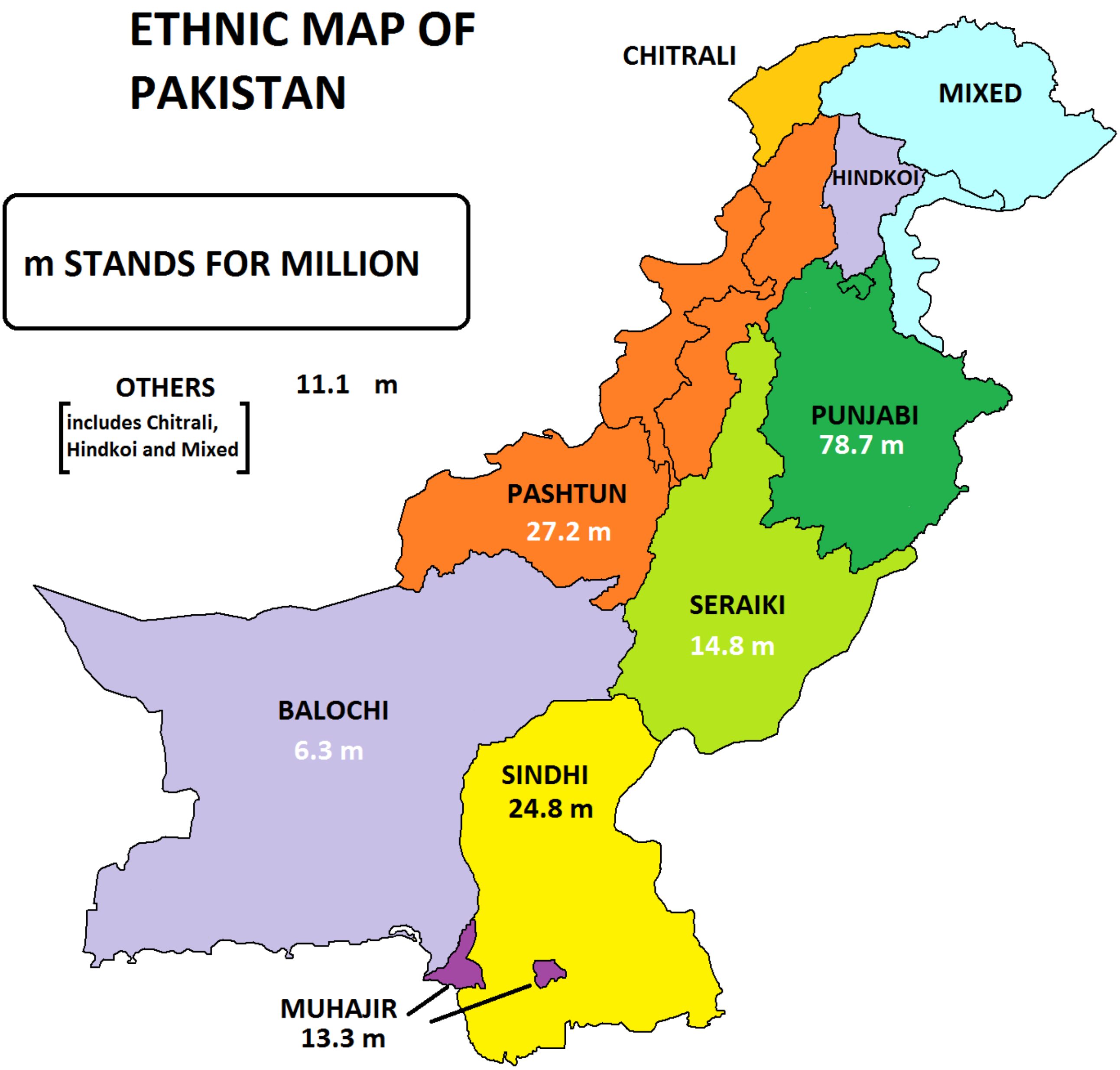
This means essentially that the slow and steady flow of ideas, machinery into the country and the ever rising exports suddenly decrease, thus having a disastrous effect on the country's economy

FACTORS	LOCATIONS			
	Punjab and Sindh Plains	**Balochistan Plateau and Northern Mountains**	**Indus Delta**	**Thar Desert**
Topography and Drainage	• Flat plains with no steep slopes	• Steep slopes with deep narrow valleys	• Marshy area with few flat areas • Land is swampy	• Sand dunes are present along with interdunal valleys
Water supply and other resources	• Ample water is available throughout the year from a network of rivers and canals	• Water is only available during the rainy season (Balochistan Plateau) • Water is available throughout the year (Northern Mountains), although sometimes rivers may be frozen	• Water is salty and polluted due to industrial waste • Groundwater is not fit for crop growth	• Water table lies too deep. Suitable water is only available during the rainy season
Crop growth	• Various crops can be grown throughout the year • 2-3 harvests are possible during the year • Irrigation supplies water throughout the year • Large number of fertilizer and insecticide factories along with machines help in increasing crop yields	• Only some crops can be grown during the year (due to temperature and sunlight limitations) even with irrigation supply • Fertilizer and insecticide supply is limited • Machines can't be used on hilly slopes	• Crops can't grow in salty soil • Furthermore, the land may be flooded during high tide, which suffocates the plant	• High rate of evapotranspiration prevent plants from attaining maximum growth • The soil particles are loosely arranged, thus any nutrients present are quickly leached when water is supplied/rain • It is difficult to use machines in between sand dunes
Infrastructure	• Large numbers of factories provide employment to millions of people • Gas, water and electricity supply is available to both homes and industry	• Gas, water and electricity supplies are only limited to some populated areas. Thus the number of industries is low • Road, railway and air network are limited due	• Gas, water and electricity supplies are only limited to some populated areas	• Gas, water and electricity supplies are almost non-existent • Road, railway and air network is almost non-existent too

	• Roads, railways and airports are present for transporting people, raw materials and products • Good health and education facilities	to the harshness of terrain and the building costs. • Less number of healthcare and educational facilities.	• Road, railway and air network is limited due to the semi-inundated terrain (no firm foundation). • Limited number of schools and hospitals	• Few schools and hospitals
Climate	• Two main weather systems are present, thus bringing rainfall throughout most of the months of the year • Temperatures are bearable in winters, although in summers shade is a must	• Northern mountains also have two main weather systems, which bring ample amount of rainfall throughout most months of the year. Balochistan Plateau is very much dry • Temperatures in both areas are low in winters (food can't be grown and needs to be stockpiled) and mild in summers. • Avalanches in northern areas can cause problems by disrupting trade and transport	• Rainfall occurs during the monsoon season. Amount is low • Temperatures are moderate in summers and winters due to affect of the sea but humidity remains high	• Low amount of rainfall occurs from the monsoons • Temperatures are very high in summers and bearable in winters. Sand storms blow in summer months and may cover crop areas (encroaching farming land) causing desertification
Vegetation	• Tropical thorn forests are present. They can be used for firewood and timber etc	• Coniferous and alpine forests along with thorny bushes are present. Can be used for timber, firewood, paper etc	• Mangroves are present. They cover a large area and are difficult to cut	• Only thorny bushes are present and can be easily removed

DO NOT WRITE THAT NO INFRASTRUCTURE IS PRESENT IN FOR EXAMPLE INDUS DELTA, IT IS PRESENT BUT LIMITED

Fig14.6


ETHNIC MAP OF PAKISTAN
m STANDS FOR MILLION
OTHERS 11.1 m
[includes Chitrali, Hindkoi and Mixed]
CHITRALI
MIXED
HINDKOI
PUNJABI
78.7 m
PASHTUN
27.2 m
SERAIKI
14.8 m
BALOCHI
6.3 m
SINDHI
24.8 m
MUHAJIR
13.3 m

TOURISM IN PAKISTAN

Khyber-Pakhtunkhwa, Azad Kashmir and Gilgit-Baltistan

- Many people visit these areas because of the cool climate that persists there in the summer months
- Beautiful scenery includes mountain tops, valleys and above all conifer and alpine forests



Fig14.7

- Fast flowing rivers make narrow gorges and spectacular waterfalls
- Jeep rides and hiking also provide entertainment to tourists
- Presence of small scale cottage industry is also very helpful in growth of industries here with production of small carpets , wood engravings (tourists buy these) etc

Punjab

- It is known for its cultural heritage with sites like Harappa and Taxila both encompassing Indus Valley and Gandhara civilizations respectively
- The Mughal Empire built the Lahore Fort and Shalimar Gardens which are now recognized as World Heritage Sites. The Walled City of Lahore and Badshahi Mosque are also important tourist destinations
- The Derawar Fort is a large fort built in the Cholistan Desert, which is also the site for the annual Cholistan Jeep Rally
- The Khewra Salt Mines is another major tourist attraction as its one of the oldest mines in South Asia.
- The city of Nankana Sahib is birthplace of the founder of Sikhism. The Gurdwara is visited by a number of pilgrims ever year to mark Guru Nanak Dev birthday
- Multan is another major tourist destination in Punjab. It is known for its mausoleums of saints and Sufi pirs

Sindh

- Mohenjo-daro near the city of Larkana was one of the largest city-settlements in South Asia and is a official UNESCO World Heritage Site
- Some of the most notable lakes in Sindh include: Keenjhar Lake, Manchar Lake and the Bakri Waro Lake in Khairpur.
- The Kirthar National Park is also a protected reserve for several wildlife species within the region.
- The Great Rann of Kutch is a protected wetland site in the province. There are two wildlife sanctuaries in the province
- The Sukkur Barrage is another famous icon in the province it was built to alleviate famines caused by lack of rain



Fig14.8



Fig14.9

- Karachi is home to the tomb (Mazar-e-Quaid) of founder of country, Mohammad Ali Jinnah. Also it has many famous beaches like Clifton Beach, French Beach, Sandspit Beach and Manora Island

Balochistan

- Balochistan is home to one of the oldest Neolithic (7000 BC to c. 2500 BC) sites in archaeology. Mehrgarh and Nausharo, was an ancient city linked to the Indus Valley Civilization.
- There are a number of sites of interest including the protected Hazarganji-Chiltan National Park, Hanna Lake
- The Quaid-e-Azam Residency (Fig14.9) is another major site in Balochistan in the city of Ziarat. Ziarat is also famous for the juniper forests which are the oldest and largest in the world
- Sibi is an important historical city in Balochistan. The annual Sibi Festival marks the famous Horse and Cattle Show
- There are a number of mountain passes within Balochistan. The Bolan Pass has been the main entrance to the provincial city of Quetta. There are several others including Lak Pass, Khojak Pass and Harnai Pass.
- The Balochistan coastline extends from the Sindh province to the Iranian border measuring a total distance of over 750km. Along the Makran Coastal Highway there are several rock formations as well as Kund Malir and the Hingol National Park



Fig14.10 Princess of Hope

Importance of Capital in Tourism

- Capital is required for advertising sites in Pakistan and to introduce them either on different channels or online etc
- Capital is required for maintenance and building of infrastructure like roads, railways and sewage. The tourists utilize these facilities along with the common man
- Capital is also used to provide security to international tourists to prevent attacks on them because any such attacks makes the collapse the tourism industry a dangerous possibility

Advantages of Tourism

- Employment opportunities are generated for locals. The income can be used by them to buy increased amount of goods raising their standard of living
- The infrastructure of that area like sanitation, water, education, healthcare, electricity all is developed by the government to attract tourists. This infrastructure is used by locals as well as tourists
- The development of these facilities can lower the infant mortality and the death rate in rural areas
- The money generated may also be spent on maintaining these tourist and cultural sites for the future as tourism is a sustainable industry
- The local people might themselves want to maintain their incomes by re-planting forests, so scenic beauty is maintained. This helps improve the environment
- Tourism helps in generating foreign exchange; this can be used to pay off debt. This results in Pakistan having more money to spend on things like education, health etc
- Helps in better understanding of different cultures thus improving relations between people of different nationalities

Disadvantages of Tourism

- Firstly the environment suffers a lot if the number of tourists exceeds the capacity of the place. For example in Murree the rapid urbanization and growth of tourism has meant that many forests have been cut to make way for rising hotels etc
- This has led to increased deforestation and soil erosion etc, so these areas are quickly losing their beauty for which the tourists come
- The sanitation systems also bear the strain; much of the sewage is dumped raw into the rivers. The water quality decreases and kills the fish. Fishing here is an important source of income for the local people
- Capital is required for advertising sites in Pakistan and to introduce them either on different channels or online etc. Sometimes it is better to spend it somewhere else like on education, health sector
- Also, sometimes locals resent the presence of too many foreigners who take too many pictures of them
- Furthermore, there is no guarantee that tourists will come. People may be put off by the security situation in the nearby areas, even if the tourist site may be well protected and secure

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"Sheoshar Lake in the Deosai National Park, Baltistan"

Picture by Sarfraz Hyat



Deosai means the "Land of Giants". Deosai National Park is at an average elevation of 4,114 metres (13,497 ft) above the sea level, making the Deosai Plains the second highest plateau in the world, after the adjacent Tibetan Plateau

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"I am an A level student at Lahore Grammar Sc[redacted]an and social dimensions of Pakistan's development in contemporary times and I inte[redacted] My textbook will hopefully serve the needs of students of O levels and teachers. It may a[redacted]equire insight into Pakistan's human and social aspects for extra-curricular purposes li[redacted] may also find it as a valuable guide."